DATA REPORT: NOGAP B.6; BEAUFORT SEA OCEANOGRAPHY, SEPTEMBER, 1986

by

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Les établissements des Sciences et Levés océaniques dans les régions et à l'administration centrale ont cessé de publier leurs diverses séries de rapports depuis décembre 1981. Vous trouverez dans l'index des publications du volume 38 du *Journal canadien des sciences halieutiques et aquatiques*, la liste de ces publications ainsi que le dernier numéro paru dans chaque catégorie. La nouvelle série a commencé avec la publication du Rapport n° 1 en janvier 1982.

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Abstract

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A cruise to the Southern Beaufort Sea was carried out in September, 1986. This comprises part of the NOGAP B.6 program with major objectives to determine hydrocarbon pathways and primary productivity of the waters overlying the Mackenzie Shelf. Here we report the supporting geochemical measurements, including salinity, temperature, nutrients (silicate, phosphate and nitrate), oxygen isotopes, chlorophyll *a*, total suspended solids (TSS), particulate organic carbon and nitrogen (POC, PON), and bacterial enumeration.

Key words: Arctic, bacteria, chlorophyll *a*, coastal zone, nutrients, oceanography, oxygen isotopes, POC, PON, salinity, temperature, total suspended solids.

Résumé

Macdonald, R.W., K. Iseki, E.C. Carmack, D.M. Macdonald, M.C. O'Brien, and F.A. McLaughlin 1988. Data Report: NOGAP B.6; Beaufort Sea Oceanography, September, 1986. Can. Data Rep. Hydrogr. Ocean Sci: 58, 68pp.

Une campagne a été effectuée vers la mer de Beaufort du sud en September, 1986. Cette expédition a compris une partie du programme NOGAP B.6, comme objectifs principaux les trajectoires des hydrocarbures et la production primaire des eaux au-dessus du plateau continental Mackenzie. Nous reportons ici sur les mesures géochimiques d'appui en comprenant la salinité, la température, les nutriments (silicate, phosphate et nitrate), les isotopes d'oxygène, le chlorophylle *a*, les sédiments transportés en suspension, les particules de carbone organique et d'azote, et l'énumération bactérienne.

Mots-clé: Arctique, bacteria, chlorophyll *a*, zone côtière, nutriments, océnographie, isotopes d'oxygène, POC, PON, salinité, température, sédiments en suspension au total.

Acknowledgements

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1 INTRODUCTION

As part of an inter-disciplinary study (NOGAP-B.6) to measure the transport and fate of hydrocarbons over the Beaufort Shelf, and primary productivity of these coastal waters, we conducted a cruise on the *Arctic Ivik* chartered from Arctic Transport Ltd. (ATL) in September, 1986.

The oceanographic samples collected during the cruise are listed below; **bold** font is used for data which have been fully analyzed and are reported in the accompanying tables, normal font is used for data which have been collected concurrently and are, or will be, available elsewhere. Data reported here are entered in a Symphony spreadsheet format.

The *Arctic Ivik* was chartered from ATL and was not designed as an oceanographic vessel. Therefore, during the 7 day cruise, work was carried out in two small compartments which were accessed directly from the afterdeck. The conditions for performing shipboard work were minimal; we avoided sample handling where possible. Water subsampling, and water filtrations were carried out on the ship; all other sample processing was done on the return to the Institute of Ocean Sciences (IOS). Samples were transported to IOS either in small insulated coolers (frozen or cooled and air transported with the personnel) or by the CSS Tully storing them in that ship's freezer or walk-in cooler where appropriate.

The following were sampled:

- Water samples (hydrocasts); **salinity, temperature, nutrients (reactive silicate, phosphate, nitrate plus nitrite), oxygen isotopes, total suspended solids, particulate organic carbon and nitrogen, chlorophyll a**, productivity, total carbon dioxide, phytoplankton, **bacterial enumeration**, and particle identification by scanning electron microscopy.
- Radium isotopes.
- Water samples (Seastar Pump, and NBS sampler); hydrocarbons, particulate and dissolved.
- Suspended particles (Sedisamp centrifugal system); hydrocarbons.
- Zooplankton (net hauls; 300 μm mesh, 0.45 m diameter, 1.5 m length, preserved in buffered formalin).
- Conductivity, Temperature, % Transmission and Pressure; Applied Microsystem and Guildline CTTD systems.
- Light intensity; Photosynthetically Active Radiation (PAR) was measured continuously during the cruise (LI-COR quantum sensor LI-190SB), and with vertical profiles (LI-COR underwater spherical quantum sensor LI-193SB).
- Satellite imagery; temperature, turbidity, and ice distribution.
- Short-term (5-day) sediment trap (bongo), Aanderaa current meter, and Seastar water sampling pump (moored at station 4).

1.1 Stations

The station locations were determined from a transit Satellite Navigator by the ship's officers. The majority of positions are expected to be within 930 m of the true position, with a mean displacement of about 476 m [*Huggett and Mortimer;* 1971]. Figure 1 shows the location of stations; station coordinates are given in the station headers on the data tables. Coverage extended beyond

Table 1: Estimates of error: basis of calculation and error models are given in the text.

measurement	units	precision (s_p)	Standard Reference Material
Salinity	psu	0.005	IAPSO Seawater
Temperature	^oC	0.016	NBS Calibration
$\delta^{18}O$	$^o/_{oo}$	0.11	V-SMOW
Silicate	mmol m^{-3}	0.4	Sagami
Nitrate	mmol m^{-3}	0.3	Sagami
Phosphate	mmol m^{-3}	0.04	Sagami
TSS	mg l^{-1}	0.04	No SRM available
POC	μg l^{-1}	1.5	Acetanilide
PON	μg l^{-1}	0.2	Acetanilide
Chl *a*	mg m^{-3}	0.04	No SRM available

the shelf break (200 m), reflecting the distance of ice retreat; only at station 17 did we approach noticeable quantities of floating ice.

2 METHODS

The sampling and analytical methods for the measurements are reported below and results are summarized in the accompanying tables. Errors expressed as precision and accuracy are summarized in Table 1. Pooled variance, s_p, is calculated as

$$s_p = \sqrt{\frac{\nu_1 s_1^2 + \cdots + \nu_i s_i^2}{\nu_1 + \cdots + \nu_i}}$$

where $\nu_i = n_i - 1$ degrees of freedom, and the n_i and s_i refer to the number of replicates and their standard deviation for the individual components used in the pooled standard deviation calculation.

The 5 *l* Niskin and 10 *l* Go-Flo bottles were subsampled as follows: samples for dissolved oxygen and total carbon dioxide were drawn first by using tygon tubing and overflowing the sampling flask. Next, salinity, nutrients and oxygen isotopes were subsampled, followed by water for phytoplankton identification and ^{14}C productivity. The thermometers were then read, and the samplers were gently shaken upside-down three times to homogenize the particulates. After two rinses, the remaining contents of the water bottle were drained into a polyethylene carboy via a polyethylene funnel. This carboy was then subsampled, with continuous gentle shaking, for the particulate samples (POC, PON, TSS and Chl *a*).

2.1 Salinity

Salinity samples were drawn into 200 m*l* salinity bottles after 3 rinses from 10 *l* Go-Flo bottles or 5 *l* Niskin bottles. The samples were then capped tightly and returned to IOS by the CSS Tully. Care was taken to avoid freezing.

The salinities were analyzed at IOS on a Guildline Autosal (Model 8400A) instrument maintained in the Ocean Physics Division, and are reported in practical salinity units (psu) [see *Lewis and Perkin*; 1978]. During analyses the instrument was standardized against Standard Sea Water

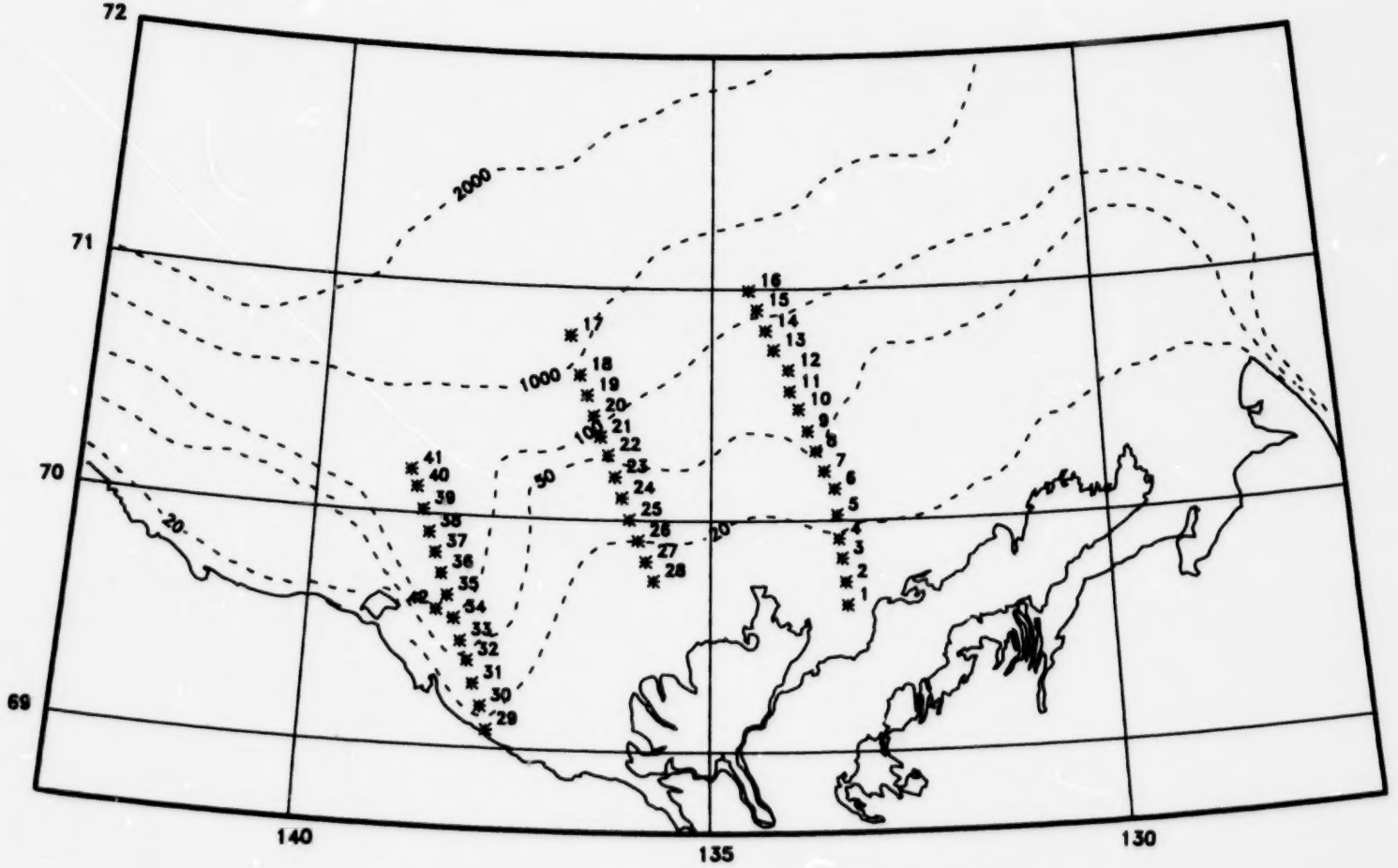

Figure 1: Station locations

of Chlorinity 19.373 (K_{15} = 0.99997). The Standard Sea Water was obtained from Standard Seawater Service, Institute of Oceanography, Wormley, Godalming, Surrey, England (P95, 8/3 1983). Standard deviation of repeated measurements on the same sample was less than 0.0003 psu, and on replicate sub-samples was 0.0051 psu (n=5). A large control sample was stored in a collapsible plastic carboy from which an air space was excluded. Salinity determination of this bulk water sample after approximately every tenth sample yielded the following statistics; 28.6653 psu ± 0.0004 psu, 13 ($\bar{X} \pm s, n$).

2.2 Temperature

Temperature was measured with paired oceanographic restricted-range thermometers (low temperature) manufactured by Richter and Weise (Berlin), or Yoshino Factory (Tokyo). These were read twice to the nearest 0.01 C°; agreement between pairs was $s_p = 0.016°C$ (for 53 pairs).

2.3 Dissolved Oxygen

Due to problems with the Micro-Winkler oxygen titration assembly which we were unable to correct during the cruise, no valid measurements were made; we ceased subsampling for oxygen on the second day.

2.4 Nutrients

Samples for nutrient determination were collected into twice rinsed glass and polystyrene test tubes (2 glass and 3 polystyrene tubes per sample), quick frozen in an upright position, and stored in a freezer until analysis. Where there was visible turbidity the samples were filtered through a washed (200 m*l*) Millipore 0.45 μm type HA membrane filter before being subsampled into tubes. Frozen samples were returned to IOS by the CSS Tully; acidified samples were air transported to IOS stored in a 4°C cooler.

For a subset of 25 samples where salinity was less than 27 $^o/_{oo}$, two additional plastic tubes were filled, 100 μl of 10N H_2SO_4 was added and the samples were stored at 4°C until analysis. These were collected for the purpose of evaluating acidification as a storage method for silicate analysis.

In addition, a salty, clear sample was collected and subsampled into 20 glass and 20 polystyrene tubes to provide a control sample.

Nutrient determinations were performed using Technicon Autoanalyzer II components. Reactive silicate and nitrate plus nitrite were determined according to Technicon Industrial Methods No. 186-72 W and 158-71 W respectively, and soluble orthophosphate was determined using a modified Technicon method [*Brynjolfson;* 1973]. Sagami standards, prepared in 30.5$^o/_{oo}$ NaCl solutions, were used to calibrate secondary standards which were prepared daily. Six replicates of the control sample were analyzed each analytical day. In addition, 20% of the samples, both frozen and acidified, were relabelled and analyzed as blind replicates.

Phosphate and nitrate concentrations were determined on samples thawed and analyzed immediately. The silicate concentrations were determined on frozen samples by thawing them for 24 hours [see *Macdonald et al;* 1986] before analysis. Both phosphate and nitrate values were corrected based on turbidity and salt effect lines. This was not required for silicate.

The precision of the methods based on blind replicates and control samples was found to be: silicate, s_p = 0.6 mmol m^{-3}, $\Sigma\nu$ = 25; phosphate, s_p = 0.05 mmol m^{-3}, $\Sigma\nu$ = 45; nitrate, s_p = 0.3 mmol m^{-3}, $\Sigma\nu$ = 40.

2.5 Oxygen Isotopes

Following 3 rinses, water was sampled into 200 m*l* salinity bottles, the cap was tightly sealed, and samples were returned to IOS on the CSS Tully. Analysis for oxygen isotopes was carried out by Geotop (Université du Québec à Montréal). The method of analysis is based on that of *Epstein and Mayeda* [1953] which relies on an equilibration of the water sample with CO_2. Equilibrated CO_2 gas was extracted and analyzed by mass spectrometer (SIRA 12, V.G. Instruments) for $^{18}O/^{16}O$ composition. Reference CO_2 gas was prepared by acidification of marble with phosphoric acid at 25.1°C. This gas was accurately referenced against international standards. Results were reported as referenced against Standard Marine Ocean Water, Vienna (V-SMOW), and reported as

$$\delta^{18}_{V-SMOW} = \left[\frac{(^{18}O/^{16}O)_{sample}}{(^{18}O/^{16}O)_{V-SMOW}} - 1 \right] \times 1000^{o}/_{oo}$$

The precision of the mass spectrometer measurement is reported by Geotop to be $0.02^{o}/_{oo}$, and statistical reproducibility (1 σ) on the determination of a single sample $0.07^{o}/_{oo}$ (includes error in the mass spectrometer determination and in sample preparation steps). The above estimates of error were confirmed by submission of 15 blind replicates among our samples for which the pooled standard deviation was $0.11^{o}/_{oo}$. Absolute accuracy against V-SMOW was confirmed by plotting $\delta^{18}O$ against salinity and comparing the results with other measurements made in the Arctic and Atlantic oceans.

2.6 Total Suspended Solids

Sampling and analytical methods are detailed in an Ocean Chemistry protocol [*Macdonald et al.*;1983], and are described briefly below.

Following gentle shaking of the polyethylene carboy, volumes of water ranging from 1 *l* to 4 *l* were subsampled into 2 *l* polybottles. As much water as possible (depending on particle loading) was then filtered through a pre-washed and pre- weighed 0.45 μm, 47 mm Nuclepore filter using glass castles mounted on a vacuum manifold. The volume filtered was recorded to the nearest 10 m*l*. After the filtered water had passed through the filter, it was rinsed with three 10 *ml* portions of pH8 Milli-Q water followed by three small rinses around the filter perimeter after the castle had been removed. Blanks were prepared by periodically placing a second filter underneath. All filters were stored in acid-cleaned petri slides in a freezer and returned to IOS.

Filters were dried at 40°C overnight and weighed on a Mettler M3 autobalance to the nearest 0.001 mg. Calibration was carried out with an internal 100 mg weight. The instrument is linear, and calibration does not appear to contribute significantly to error; the major weighing problem is static, and this was controlled with a Po α-source static eliminator. For the data reported here, the blanks were found to be less than 0.01 mg/*l*, s=0.012, n=20. The pooled standard deviation of replicate determinations was s_p = 0.04 mg/*l*, n=9. Repeatability of deep water measurements where particle concentrations are very low suggest that the precision of the method, including errors of sampling, sample handling, blank correction and weighing, is less than $\pm$0.05 mg/*l* (1 σ). Absolute accuracy of the balance has been established to be better than $\pm$0.01 mg by reference to the class 5 NBS weights; absolute accuracy of the method of filtration is defined by the operation of passing through a 0.45 μm filter [see *Brewer et al.*; 1976].

2.7 Particulate Organic Carbon and Nitrogen

Water samples (1-4 *l*) were vacuum filtered ($\leq$ 150 mm Hg) through single 47 mm diameter pre-combusted (500°C, 1hr) Whatman GF/C glassfiber filters. The residue on each filter was rinsed

with 10 m*l*, 3% NaCl solution. Filters were then stored inside pre-combusted aluminum foil in a deep freezer (-20°C) until analysis. Blank filters were prepared by treating them like sample filters without filtering a water sample. Organic carbon and nitrogen on the filters were analyzed using a Perkin-Elmer Model 240 elemental analyzer after the filter had been treated with concentrated HCl vapour in a closed container for 8 hours to remove inorganic carbon. Blanks were equivalent to 6.1 μg C/*l* (s= 1.5 μg/*l*, n=5) for a one *l* sample [see *Iseki et al.*;1986]. Acetanilide was used to standardize the instrument for carbon and nitrogen. Precision for the method was estimated from the regression on the calibration curve, and the standard deviation around the blanks.

2.8 Chlorophyll *a*

Water samples (0.25-0.50 *l*) were filtered through 24-mm diameter Whatman GF/C glass fiber filters. Approximately 1 m*l* of 1% $MgCO_3$ solution was added to the samples just before filtration was complete. The inside of the filtration funnel was rinsed with about 10 m*l* of filtered sea water while continuing the filtration. After filtration, the filters were folded in half, placed in filter paper folded into quarters, labelled, and stored frozen in a dark bottle with silica-gel in a deep freezer. Chlorophyll *a* was determined fluorometrically with a Turner Design fluorometer [*Strickland and Parsons*; 1972]. Blanks were estimated from deep samples (where chlorophyll concentrations are low) to be less than 0.02 mg m^{-3} (s=0.01, n=10), and pooled standard deviation of replicates less than 0.04 mg m^{-3} (n=12).

2.9 Bacterial Enumeration

Water samples (2 m*l* and 20 m*l* for each sample taken) were filtered onto Nuclepore filters [see *Hobbie et al;* 1977] and the filters were maintained in a cooler until returned to the lab. Bacterial counting was performed by S. Jasper using the epifluorescence procedure outlined by *Hobbie et al.*, [1977] with modifications as described by *MacIssac and Stockner*, [1985]. In most cases a minimum of 400 cells per sample were counted which, assuming random distribution of cells on the filter, leads to a confidence interval of ± 10% [*Utermohl;* 1958]. That is, the observed mean grid count is within ±10% of the true mean grid count. Additional errors in filtration and sampling would probably increase this to about ± 20%. Background counts (i.e. bacteria contained in the staining and rinsing solutions) were always ≤2.5 per grid; an average of 1.9 per grid was used to correct sample mean grid counts. To convert from these corrected mean grid counts to actual numbers per m*l*, a filtration area of 199.56 mm^2 and grid area of 0.004489 mm^2 were used.

Almost all the bacteria (about 99%) were solitary and unattached to detrital or other material. Several examinations of higher density samples (i.e. the 20 m*l* filters), did not reveal any large conglomerations of attached bacteria that might have been missed on the lower density filters.

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4 APPENDIX 1; DATA TABLES

STATION: 1 DATE: 10/09/86 TIME: 0805 (Z+6)
DEPTH: 6 m
LATITUDE: 69 38.0 N LONGITUDE: 133 17.5 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	1	6.15	18.46	14.50		-9.8	0.25	23.7	0.6
3	2	6.06	18.94	14.88		-9.5	0.22	22.0	0.7

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	1	2290.0		250.6		0.590		2.325	181.29	
3	2	3657.4		387.9		0.778		3.359	224.82	

STATION: 2

DATE: 10/09/86
DEPTH: 9 m
LATITUDE: 69 44.0 N

TIME: 1058 (2+6)
LONGITUDE: 133 18.8 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	3	7.09	14.54	11.34		-11.4	0.14	31.1	0.7

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	3	233.1		39.8		2.266		0.148	8.93	

STATION: 3

DATE: 10/09/87
DEPTH: 14 m
LATITUDE: 69 50.1 N

TIME: 1303 (Z+6)
LONGITUDE: 133 21.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	4	5.85	21.12	16.62		-8.1	0.21	14.8	0.5

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	4	197.4		29.4		0.768		0.436	3.75	

STATION: 4

DATE: 10/09/86
DEPTH: 20 m
LATITUDE: 69 55.2 N

TIME: 1435 (Z+6)
LONGITUDE: 133 23.2 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	5	8.40	22.85	17.70		-6.9	0.28	11.8	0.1
3	6	5.26	22.91	18.08		-6.9	0.29	11.7	0.3
5	7	5.16	22.96	18.13		-6.9	0.26	11.5	0.3
7	8	4.95	23.06	18.23		-6.8	0.33	11.2	0.1
10	9	3.00	26.22	20.88		-4.7	0.46	6.2	
15	10	0.07	30.55	24.51		-3.7	0.95	8.9	1.5

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	5	205.0	95.5	27.3	15.1	0.342	0.361	0.331	1.04	1.09
3	6	165.5	101.2	27.2	14.6	0.216	0.570	0.197	0.85	
5	7	130.4		21.1		0.330		0.247	1.01	
7	8	171.0	108.6	25.2	16.1	0.183	0.330	0.133	0.85	
10	9	100.0		16.5		0.359		0.242	1.09	
15	10	192.6		28.3		0.245		0.191	5.91	0.52

STATION: 5

DATE: 11/09/86
DEPTH: 30 m
LATITUDE: 70 01.4 N

TIME: 0800 (Z+6)
LONGITUDE: 133 24.4 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	11	5.10	22.73	17.96		-6.7	0.30	11.9	0.2

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	11	133.3		16.8		0.332		0.202	0.65	0.80

STATION: 6

DATE: 11/09/86 TIME: 0930 (2+6)
DEPTH: 41 m
LATITUDE: 70 08.2 N LONGITUDE: 133 26.0 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	12	5.14	22.86	18.05		-7.1	0.36	12.2	0.1

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	12	140.1		23.2		0.413		0.257	0.99	0.98

STATION: 7 DATE: 11/09/86 TIME: 1040 (Z+6)
DEPTH: 52 m
LATITUDE: 70 12.8 N LONGITUDE: 133 33.6 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	13	5.50	19.91	15.70		-8.5	0.25	18.3	0.1
3	14	5.30	20.15	15.90		-8.9	0.24	17.0	0.1
5	15	5.14	20.43	16.14		-8.8	0.26	16.1	0.1
7	16	4.32	21.26	16.85		-8.1	0.28	15.1	0.1
10	17	2.60	23.88	19.04		-6.5	0.38	10.1	0.2
20	18	-1.10	31.15	25.04		-3.8	0.94	6.9	1.0
30	19	-1.41	31.65	25.45		-3.5	1.04	8.2	1.7

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	13	159.0		23.2		0.269		0.190	0.94	1.72
3	14	123.6	119.9	20.2	20.2	0.719	0.661	0.479	0.81	
5	15	152.8	89.6	24.6	15.0	0.601	0.436	0.438	0.95	
7	16	159.6		24.6		0.674		0.451	0.85	
10	17	120.0		20.4		0.429		0.274	0.66	
20	18	64.1		10.3		0.216		0.121	1.09	
30	19	42.1		6.2		0.101		0.078	0.48	0.26

STATION: 8

DATE: 11/09/86
DEPTH: 57 m
LATITUDE: 70 18.0 N

TIME: 1445 (Z+6)
LONGITUDE: 133 40.2 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	20	6.01	19.54	15.36		-9.0	0.24	18.4	0.1

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	20	125.2		22.9		0.873		0.583	1.26	0.89

STATION: 9

DATE: 11/09/86 TIME: 1607 (Z+6)
DEPTH: 58 m
LATITUDE: 70 23.2 N LONGITUDE: 133 46.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	21	8.13	20.07	15.56		-8.6	0.21	17.6	

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	21	111.6		17.7		0.619		0.384	0.77	1.33

STATION: 10 DATE: 11/09/86 TIME: 1926 (Z+6)
DEPTH: 62 m
LATITUDE: 70 28.9 N LONGITUDE: 133 52.8 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	22	5.36	19.94	15.72		-8.6	0.19	17.7	0.1
3	23	5.35	19.93	15.72		-8.7	0.20	17.8	0.1
5	24	5.33	19.93	15.73		-8.7	0.16	16.0	0.1
7	25	5.25	20.01	15.80		-8.7	0.20	17.7	0.1
10	26	1.69	25.86	20.67		-5.6	0.48	9.7	0.1
20	27	-1.26	31.49	25.32		-3.5	0.81	3.6	
30	28	-1.46	31.65	25.45		-3.5	0.82	4.9	0.3
50	29	-1.45	32.30	25.98		-2.7	1.57	24.8	9.0

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	22	114.2		17.8		0.443		0.412	0.56	1.51
3	23	113.7		18.9		0.495		0.307	0.65	
5	24	110.8		18.3		0.391		0.358	0.61	
7	25	111.3		18.3		0.460		0.365	0.67	
10	26	81.8		16.0		0.706		0.279	0.39	
20	27	33.8		6.4		0.205		0.191	0.16	
30	28	39.8		6.2		0.142		0.190	0.11	
50	29	72.4		9.9		0.053		0.069	0.75	0.33

STATION: 11

DATE: 11/09/86
DEPTH: 61 m
LATITUDE: 70 33.5 N

TIME: 2255 (Z+8)
LONGITUDE: 133 59.6 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN nmol/m3	DELTA O18	PHOSPHATE nmol/m3	SILICATE nmol/m3	NITRATE nmol/m3
0	30	5.03	19.69	15.56		-8.8	0.23	17.9	0.1

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	30	133.0		22.7		0.576		0.306		1.70

STATION: 12

DATE: 12/09/86
DEPTH: 62 m
LATITUDE: 70 39.0 N

TIME: 0036 (Z+6)
LONGITUDE: 134 00.6 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	31	4.31	20.74	16.44		-7.8	0.29	14.1	0.1

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	31	110.6		18.8		0.337		0.252	0.47	1.47

STATION: 13 DATE: 12/09/86 TIME: 0136 (2+6)
DEPTH: 62 m
LATITUDE: 70 44.2 N LONGITUDE: 134 12.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	32	3.62	21.94	17.44		6.8	0.33	11.4	
3	33	3.64	21.94	17.44		-6.2	0.33	11.2	
5	34	3.60	21.98	17.47		-6.1	0.34	11.2	
7	35	1.65	24.62	19.68		-5.0	0.37	5.2	0.1
10	36	1.15	26.04	20.84		-4.2	0.45	4.2	
20	37	-1.42	31.38	25.23		-3.5	0.85	6.0	0.1
30	38	-1.43	31.56	25.38		-3.5	0.90	5.2	0.5
50	39	-1.49	32.02	25.75		-2.9	1.22	15.5	5.7

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	32	96.1		16.8		0.208		0.118	0.35	0.67
3	33	89.3		15.4		0.177		0.127	0.34	
5	34	113.5		21.0		0.107		0.321	0.41	
7	35	78.9		12.9		0.177		0.123	0.17	
10	36	64.3		11.4		0.213		0.091	0.22	
20	37	52.4		9.8		0.399		0.415	0.14	
30	38	44.0		6.7		0.138		0.095	0.11	
50	39	51.6		6.5		0.044		0.039	0.12	1.13

STATION: 14

DATE: 12/09/86
DEPTH: 74 m
LATITUDE: 70 49.2 N

TIME: 0400 (2+6)
LONGITUDE: 134 18.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	40	3.18	21.61	17.20		-6.8	0.35	11.1	0.1

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	40	90.9		14.7		0.172		0.139	0.37	0.79

STATION: 15 DATE: 12/09/86 TIME: 0514 (Z+6)
DEPTH: 82 m
LATITUDE: 70 54.6 N LONGITUDE: 134 24.8 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	41	3.71	21.29	16.92		-7.2	0.29	12.0	0.5

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	41	96.6		15.7		0.264		0.158		0.47

STATION: 16 DATE: 12/09/86 TIME: 0620 (Z+6)
DEPTH: 280 m
LATITUDE: 70 59.6 N LONGITUDE: 134 31.2 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	42	4.39	19.74	15.65		-8.5	0.25	15.0	0.2
3	43	4.37	19.70	15.61		-8.3	0.25	15.8	0.1
5	44	4.37	19.75	15.34		-8.4	0.24	15.9	0.2
7	45	1.65	24.99	19.98		-5.1	0.42	6.7	1.6
10	46	-0.34	28.93	23.22		-4.1	0.62	4.7	
20	47	-1.41	31.30	25.17		-3.5	0.81	5.2	0.3
30	48	-1.45	31.54	25.36		-3.4	0.82	5.5	0.7
50	49	-1.49	31.82	25.59		-3.1	1.05	8.5	2.7
75	50	-1.51	32.42	26.08		-2.3	1.52	23.6	10.2
100	51		32.74			-1.8	1.70	29.6	13.8
150	52	-1.52	33.01	26.56		-1.8	1.64	32.2	14.5
200	53	-1.22	33.72	27.12		-1.2	1.63	32.1	15.0
250	54	-0.08	34.61	27.80		-0.3	1.03	15.9	12.7

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	42	133.5	126.4	20.9	23.0	0.457	0.391	0.269	0.57	2.78
3	43	166.8	108.6	23.7	18.0	0.448	0.788	0.278	0.71	
5	44	261.0		38.3		0.471		0.235	0.97	
7	45	120.0	63.9	17.4	10.5	0.448	0.556	0.212	0.44	
10	46	114.8		18.3		0.490		0.196	0.42	0.59
20	47	58.6		9.3		0.216		0.338	0.14	
30	48	100.7		11.4		0.148		0.109	0.26	
50	49	41.3		4.4		0.036		0.041	0.11	
75	50	46.1		4.4		0.031		0.040	0.43	0.17
100	51	29.7		3.2		0.014		0.027	0.24	
150	52	31.1		5.0					0.24	
200	53	45.6		4.9		0.008		0.046	0.13	
250	54	50.3		5.0					0.06	0.21

STATION: 17 DATE: 12/09/86 TIME: 1705 (Z+6)
DEPTH: 1200 m
LATITUDE: 70 47.6 N LONGITUDE: 136 51.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	55	2.76	19.44	15.50			0.24	13.2	0.1
3	56	2.79	19.44	15.50		-7.9	0.24	13.1	0.1
5	57	2.79	19.44	15.50		-7.8	0.21	13.0	0.1
7	58	2.88	19.45	15.50		-7.7	0.24	13.1	0.1
10	59	-0.69	27.41	22.00		-4.6	0.59	5.1	
20	60	-1.46	31.14	25.04		-3.6	0.69	5.2	0.8
30	61	-1.47	31.40	25.25		-3.6	0.80	6.1	1.0
50	62	-1.57	31.69	25.49		-3.4	0.91	6.6	1.5
75	63	-1.48	32.35	26.02		-2.4	1.48	21.8	9.6
100	64		32.63			-2.0	1.65	28.4	13.1
150	65	-1.53	33.13	26.65		-1.7	1.86	34.1	15.1
200	66	-1.20	33.76	27.16		-1.3	1.68	31.7	15.6
250	67	-0.48	34.46	27.69		-0.5	1.20	20.9	14.8
300	68	-0.01	34.66	27.83		-0.1	0.98	14.4	13.7
350	69	0.24	34.77	27.91		-0.1	0.91	11.1	13.3
400	70	0.42	34.80	27.92			0.87	9.4	13.4

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	55	107.1		18.1		0.420		0.762	0.36	0.71
3	56	90.4		16.1		0.250		0.170	0.32	
5	57	88.7		15.6		0.277		0.189	0.20	
7	58	108.9		18.1		0.267		0.161	0.34	
10	59	54.5		9.6		0.226		0.259	0.19	0.75
20	60	42.5		7.2		0.187		0.095	0.13	
30	61	32.1		4.8		0.155		0.072	0.11	
50	62	38.9		6.0		0.032		0.037	0.12	
75	63	14.4		3.0		0.016		0.032	0.09	0.26
100	64	37.3		4.7		0.029		0.029	0.13	
150	65	33.9		4.4		0.017		0.026	0.15	
200	66	42.3	23.5	6.1	4.0	0.013		0.024	0.24	
250	67	25.2		2.9					0.14	0.46
300	68	46.0	33.2	5.8	5.1					
350	69									
400	70	25.6	25.3	5.3	4.6				0.11	0.07

STATION: 18

DATE: 12/09/86 TIME: 2250 (Z+6)
DEPTH: 900 m
LATITUDE: 70 37.4 N LONGITUDE: 136 43.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	71	4.34	19.36	15.35		-8.6	0.25	15.5	0.1

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	71	140.8		24.2		0.376		0.199	0.41	1.33

STATION: 19 DATE: 12/09/86 TIME: 0047 (Z+6)
DEPTH: 500 m
LATITUDE: 70 32.2 N LONGITUDE: 136 36.8 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	72	2.61	19.53	15.58		-8.0	0.29	13.9	

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	72	134.9		22.6		0.262		0.186	0.40	0.36

STATION: 20

DATE: 13/09/86
DEPTH: 70 m
LATITUDE: 70 26.9 N

TIME: 0211 (Z+6)
LONGITUDE: 136 31.1 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	73	1.99	19.41	15.50		-7.3	0.27	12.5	

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	73	116.4		17.6		0.220		0.168	0.40	1.10

STATION: 21

DATE: 13/09/86
DEPTH: 58 m
LATITUDE: 70 21.5 N

TIME: 0320 (2+6)
LONGITUDE: 136 25.5 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	74	2.54	19.57	15.61		-8.0	0.27	13.9	
3	75	2.56	19.58	15.62		-7.9	0.25	13.7	
5	76		25.66			-5.7	0.51	10.2	
7	77	-0.76	29.80	23.93		-4.2	0.81	6.7	0.4
10	78	-1.39	30.92	24.86		-3.8	0.82	6.1	0.6
20	79	-1.59	31.42	25.27		-3.6	0.92	7.5	2.1
30	80	-1.47	31.56	25.38		-3.4	0.78	5.8	0.7
50	81	-1.45	32.09	25.81		-2.8	1.34	17.1	6.8

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	74	108.4		17.6		0.238		0.160	0.50	1.20
3	75	121.5		18.3		0.217		0.086	0.42	
5	76	138.6		25.5		0.237		0.270	0.37	
7	77	65.1		11.4		0.290		0.242	0.21	
10	78	127.7		19.8		0.200		0.094		
20	79	36.2		7.5		0.084		0.033	0.17	
30	80	37.2		5.3		0.082		0.019	0.09	
50	81	39.8		5.3		0.053		0.049	0.88	0.39

STATION: 22 DATE: 13/09/86 TIME: 0508 (Z+6)
DEPTH: 56 m
LATITUDE: 70 16.8 N LONGITUDE: 136 19.2 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	82	5.15	19.79	15.63		-8.9	0.22	17.7	

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	82	120.4		21.9		0.548		0.399	0.56	1.15

STATION: 23 DATE: 13/09/86 TIME: 0640 (2+6)
DEPTH: 48 m
LATITUDE: 70 11.2 N LONGITUDE: 136 13.6 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	83	5.16	19.83	15.66		-8.8	0.23	17.9	

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	83	111.5		18.6		0.555		0.450	0.53	1.50

STATION: 24 DATE: 13/09/86 TIME: 0840 (Z+6)
DEPTH: 39 m
LATITUDE: 70 05.8 N LONGITUDE: 136 08.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	84	4.97	20.12	15.90		-9.0	0.24	17.3	0.2
3	85	4.59	20.28	16.06		-8.8	0.24	17.1	0.1
5	86	4.13	20.70	16.42		-8.5	0.29	15.1	0.1
7	87	3.55	20.97	16.67		-7.6	0.34	14.7	0.2
10	88	3.73	22.75	18.08		-8.4	0.28	16.3	0.1
20	89		25.54			-6.2	0.47	12.1	0.1
30	90	-1.37	31.80	25.57		-3.2	1.18	16.1	5.8

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	84	122.4		18.7		0.490		0.321	0.62	0.95
3	85	144.3		22.2		0.443		0.296	0.63	
5	86	113.0		19.6		0.427		0.320	0.55	
7	87	112.5		17.4		0.438		0.215	0.68	
10	88	107.3		17.5		0.404		0.215	0.57	
20	89	76.5		12.4		0.333		0.131	0.62	
30	90	66.4		9.6		0.116		0.133	0.69	0.75

STATION: 25 DATE: 13/09/86 TIME: 1230 (Z+6)
DEPTH: 29 m
LATITUDE: 70 00.2 N LONGITUDE: 136 02.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN nmol/m3	DELTA O18	PHOSPHATE nmol/m3	SILICATE nmol/m3	NITRATE nmol/m3
0	91	5.07	30.16	15.93		-8.8	0.32	17.1	0.1

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	91	117.3		19.5		0.457		0.337	0.57	1.82

STATION: 26 DATE: 13/09/86 TIME: 1340 (Z+6)
DEPTH: 20 m
LATITUDE: 69 54.8 N LONGITUDE: 135 55.2 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	92	4.85	21.13	16.71		-8.2	0.27	16.0	0.1

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	92	130.9		23.0		0.649		0.377	0.61	1.75

STATION: 27 DATE: 13 09/86 TIME: 1440 (Z+6)
DEPTH: 12 m
LATITUDE: 69 49.4 N LONGITUDE: 135 49.2 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	93	5.41	19.78	15.60		-9.0	0.22	18.1	0.1
3	94	5.43	19.79	15.61		-9.0	0.22	17.8	0.2
5	95	5.42	19.85	15.66		-8.8	0.24	18.3	0.1
7	96	5.40	20.10	15.85		-8.7	0.21	17.3	0.1
10	97	3.57	22.92	18.22		-7.3	0.33	14.9	0.3

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	93	152.4		24.0		0.792		0.458	0.90	1.58
3	94	138.7		22.7		0.417		0.284	0.89	
5	95	136.1		23.6		0.760		0.393	0.82	
7	96	148.2		25.4		0.733		0.425	0.87	
10	97	95.2		17.2		0.461		0.036	0.96	1.33

STATION: 28

DATE: 13/09/86
DEPTH: 10 m
LATITUDE: 69 44.4 N

TIME: 1744 (2+6)
LONGITUDE: 135 43.2 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	98	5.68	18.99	14.96		-9.6	0.23	21.6	0.6

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	98	117.9		19.9		0.613		0.467	2.09	1.86

STATION: 29

DATE: 14 09 86 TIME: 0014 (Z+6)
DEPTH: 12 m
LATITUDE: 69 04.8 N LONGITUDE: 137 42.8 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	99	4.10	22.68	17.99		-7.3	0.42	12.6	0.1
3	100	4.13	22.53	17.87		-7.3	0.43	12.5	0.1
5	101	4.14	22.69	18.00		-7.3	0.39	12.5	0.1
7	102	4.14	22.70	18.01		-7.3	0.40	12.3	0.1
10	103	4.07	23.04	18.28		-7.1	0.46	11.8	0.1

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	99	143.5		20.8		0.533		0.272	1.91	
3	100	159.4		23.7		0.476		0.276	2.05	
5	101	137.7		23.5		0.495		0.290	1.86	
7	102	131.1		20.7		0.363		0.218	1.89	
10	103	132.5		21.1		0.490		0.282	2.22	

STATION: 30 DATE: 14/09/86 TIME: 0204 (Z+6)
DEPTH: 27 m
LATITUDE: 69 10.8 N LONGITUDE: 137 48.0 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	104	4.09	22.16	17.58		-7.6	0.35	13.3	

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	104	103.7		16.0		0.363		0.211	0.53	

STATION: 31 DATE: 14/09/86 TIME: 0315 (Z+6)
DEPTH: 36 m
LATITUDE: 69 16.6 N LONGITUDE: 137 54.2 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	105	4.73	19.49	15.42		-8.8	0.24	16.8	

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	105	121.2		21.1		0.405		0.268	0.57	

STATION: 32 DATE: 14/09/86 TIME: 0421 (Z+6)
DEPTH: 49 m
LATITUDE: 69 22.5 N LONGITUDE: 137 59.2 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	106	4.50	20.24	16.03		-8.3	0.26	14.7	
5	108		20.24			-8.6	0.27	15.3	
7	109	4.44	20.26	16.05		-8.4	0.24	15.6	
10	110	4.44	19.94	15.80		-8.6	0.24	16.3	0.1
20	111	3.76	20.86	16.57		-7.8	0.27	14.9	0.1
30	112	2.03	26.69	21.32		-5.3	0.52	7.5	
40	113		29.94			-4.0	0.75	5.9	0.3

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	106	110.0		19.9		0.349		0.276	0.58	
5	108	150.5		22.0		0.344		0.243	1.17	
7	109	90.8		15.5		0.349		0.225	0.58	
10	110	107.3		18.6		0.396		0.264	0.67	
20	111	182.2		26.3		0.453		0.339	0.55	
30	112	70.1		13.8		0.306		0.116	0.30	
40	113	79.0		16.9		0.722		0.090	0.41	

STATION: 33 DATE: 14/09/86 TIME: 0559 (Z+6)
DEPTH: 86 m
LATITUDE: 69 27.5 N LONGITUDE: 138 05.0 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	114	3.62	21.76	17.30		-7.3	0.33	13.1	

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	114	101.0		18.7		0.363		0.165	0.41	

STATION: 34 DATE: 14/09/86 TIME: 0715 (Z+6)
DEPTH: 108 m
LATITUDE: 69 33.3 N LONGITUDE: 138 10.4 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	115	3.56	22.32	17.75		-7.3	0.34	12.4	

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	115	83.7		14.1		0.325		0.161	0.33	

STATION: 35 DATE: 14/09/86 TIME: 0810 (Z+6)
DEPTH: 140 m
LATITUDE: 69 29.1 N LONGITUDE: 138 16.5 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	116	3.47	24.42	19.42		-7.1	0.42	9.8	
3	117	3.21	24.19	19.25		-6.3	0.44	9.9	0.1
5	118	3.04	24.85	19.79		-6.4	0.40	9.1	
7	119	2.97	24.87	19.81		-5.8	0.43	9.1	
10	120	2.56	25.54	20.37		-5.5	0.41	8.3	
20	121	-1.14	30.49	24.50		-3.6	0.74	5.0	0.2
30	122	-1.44	31.30	25.17		-3.4	0.93	6.7	1.2
50	123	-1.46	31.96	25.70		-2.8	1.26	15.6	5.7

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	116	65.9		10.9		0.228		0.160	0.30	
3	117	84.8		13.6		0.211		0.171	0.36	
5	118	61.7		10.8		0.216		0.138	0.23	
7	119	67.5		12.1		0.230		0.134	0.25	
10	120	46.5		8.9		0.202		0.124	0.17	
20	121	46.5		9.5		0.542		0.091	0.24	
30	122	36.2		6.9		0.141		0.096	0.13	
50	123	19.2		5.9		0.155		0.123	0.40	

STATION: 36

DATE: 14/09/86
DEPTH: 165 m
LATITUDE: 69 44.7 N

TIME: 0940 (Z+6)
LONGITUDE: 138 21.8 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	126	3.99	20.39	16.19		-8.2	0.21	14.6	

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	126	92.9		16.6		0.472		0.254	0.44	

STATION: 37

DATE: 14/09/86
DEPTH: 205 m
LATITUDE: 69 50.0 N

TIME: 1040 (Z+6)
LONGITUDE: 138 27.0 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	127	3.54	20.33	16.17		-8.0	0.19	13.9	

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	127	105.4		19.0		0.476		0.184	0.38	

STATION: 38

DATE: 14/09/86
DEPTH: 238 m
LATITUDE: 69 55.2 N

TIME: 1140 (Z+6)
LONGITUDE: 138 32.6 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	128	3.70	20.76	16.50		-7.9	0.22	13.8	
5	129	3.78	20.39	16.20		-7.8	0.21	12.9	
7	130	2.26	26.40	21.07		-8.0	0.47	8.9	
10	131	-0.02	29.39	23.58		-4.2	0.72	5.7	0.3
20	132	-1.45	31.26	25.13		-3.4	0.92	6.4	0.9
30	133	-1.56	31.46	25.30		-3.4	0.98	6.8	1.4
75	135	-1.42	32.38	26.04		-2.8	1.54	22.5	9.3
100	136		32.40			-2.7	1.58	22.2	9.2
150	137	-1.50	32.90	26.47		-1.9	1.70	29.9	13.5
200	138	-1.41	33.48	26.93		-1.6	1.66	31.8	14.7

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	128	97.1		17.3		0.505		0.221	0.36	
5	129	107.0		17.8		0.217		0.754	0.39	
7	130	89.2		15.1		0.751		0.246	0.41	
10	131	69.9		12.2		0.777		0.140	0.23	
20	132	35.9		6.4		0.165		0.058	0.16	
30	133	23.9		3.9		0.114		0.047	0.15	
75	135	22.5		3.6		0.071		0.064	0.44	
100	136	27.6		3.3		0.072		0.084	0.22	
150	137	22.5		2.5		0.079		0.047	0.15	
200	138	18.8		2.5		0.022		0.046	0.14	

STATION: 39 DATE: 14/09/86 TIME: 1351 (Z+6)
DEPTH: 280 m
LATITUDE: 70 01.0 N LONGITUDE: 138 38.0 W

DEPTH	SAMPLE	TEMP.	SALINITY	SIGMA-T	OXYGEN	DELTA O18	PHOSPHATE	SILICATE	NITRATE
m	#	deg C	X10^3	kg/m3	mmol/m3		mmol/m3	mmol/m3	mmol/m3
0	139	3.70	20.09	15.97		-7.9	0.19	14.4	0.1

DEPTH	SAMPLE	POC CAST 1	POC CAST 2	PON CAST 1	PON CAST 2	CHLa CAST 1	CHLa CAST 2	PHEO	TSS	BACTERIA
m	#	ug/L	ug/L	ug/L	ug/L	mg/m3	mg/m3	mg/m3	mg/L	10^6/ml
0	139	105.7		17.9		0.382		0.212	0.40	

STATION: 40

DATE: 14/09/86
DEPTH: 330 m
LATITUDE: 70 06.8 N

TIME: 1457 (Z+6)
LONGITUDE: 138 43.9 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	140	3.65	20.00	15.90		-7.9	0.16	14.4	0.1

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	140	90.7		14.1		0.363		0.185	0.37	

STATION: 41

DATE: 14/09/86 TIME: 1602 (2+6)
DEPTH: 400 m
LATITUDE: 70 11.2 N LONGITUDE: 138 49.0 W

DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	152	3.72	20.33	16.16		-7.8	0.22	13.7	0.2
10	141	3.53	28.72	22.83		-4.5	0.70	7.9	0.4
20	142	-1.36	31.12	25.02		-3.3	0.93	5.8	0.6
30	143	-1.50	31.37	25.22		-3.4	0.97	7.3	1.4
50	144	-1.51	31.89	25.65		-2.7	1.20	13.0	4.9
75	145	-1.47	32.35	26.02		-2.1	1.48	22.2	9.6
100	146	-1.50	32.58	26.21		-2.0	1.58	26.4	11.6
150	147	-1.49	33.24	26.74		-1.8	1.67	32.3	14.4
200	148	-1.20	34.09	27.42		-1.0	1.42	26.7	14.9
250	149		34.62			-0.6	1.03	14.6	13.7
300	150		34.74			-0.2	1.04	11.2	13.3
350	151	0.37	34.80	27.92		-0.1	0.84	9.7	12.2

DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	152	94.0		15.9		0.391		0.242	0.46	
10	141	61.0		11.6		0.490		0.156	0.41	
20	142	55.4		8.7		0.119		0.131	0.29	
30	143	25.2		6.9		0.079		0.061	0.14	
50	144	47.9		12.6		0.092		0.081	0.33	
75	145	43.7		6.4		0.034		0.073	0.78	
100	146	45.8		8.9		0.030		0.039	0.20	
150	147	17.0		6.3		0.036		0.039	0.26	
200	148	19.4		2.6		0.015		0.023		
250	149	26.8		4.9					0.17	
300	150	44.5		7.9					0.19	
350	151	21.6		3.6					0.13	

STATION: 42

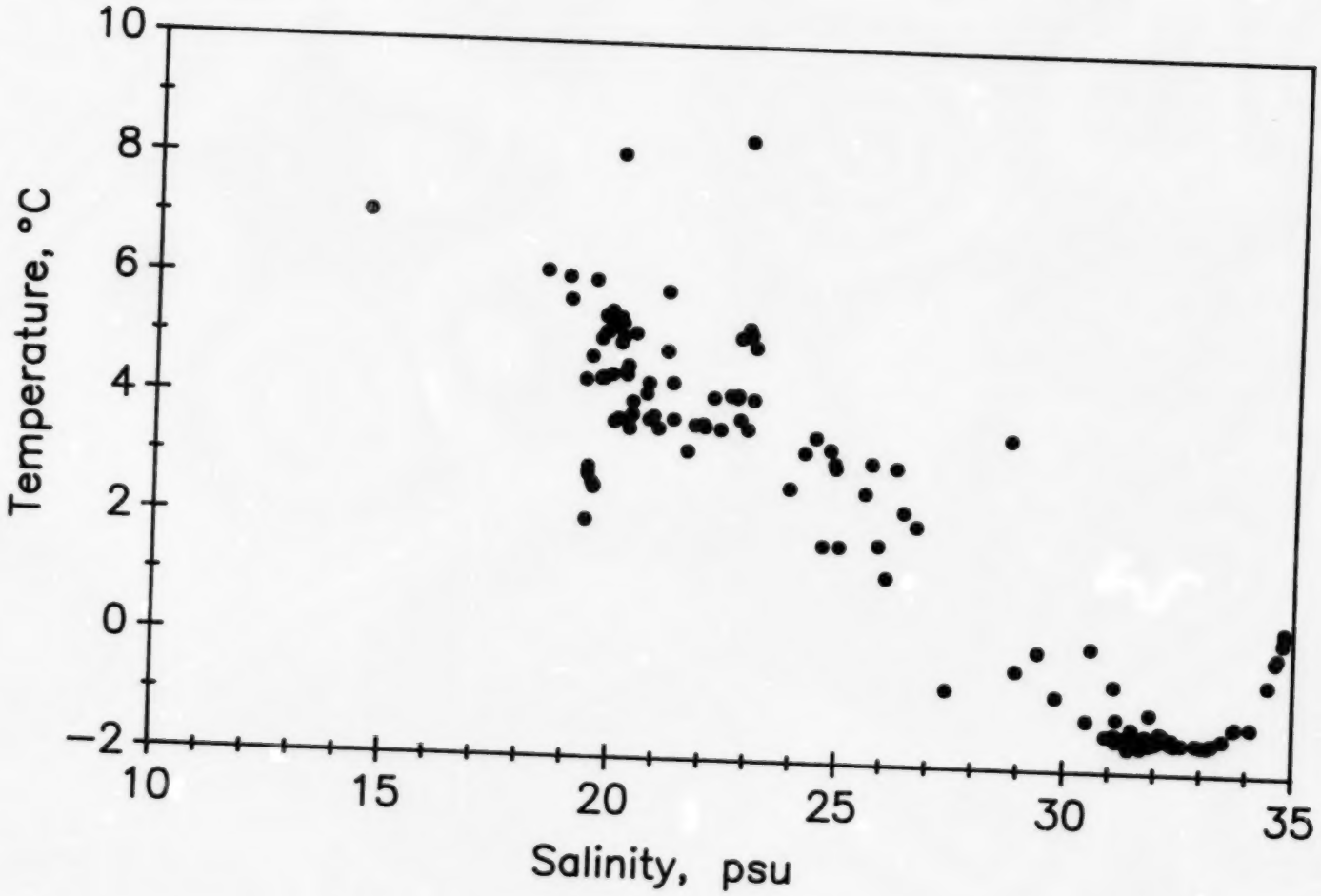
DATE: 14/09/86
DEPTH: 73 m
LATITUDE: 69 35.5 N

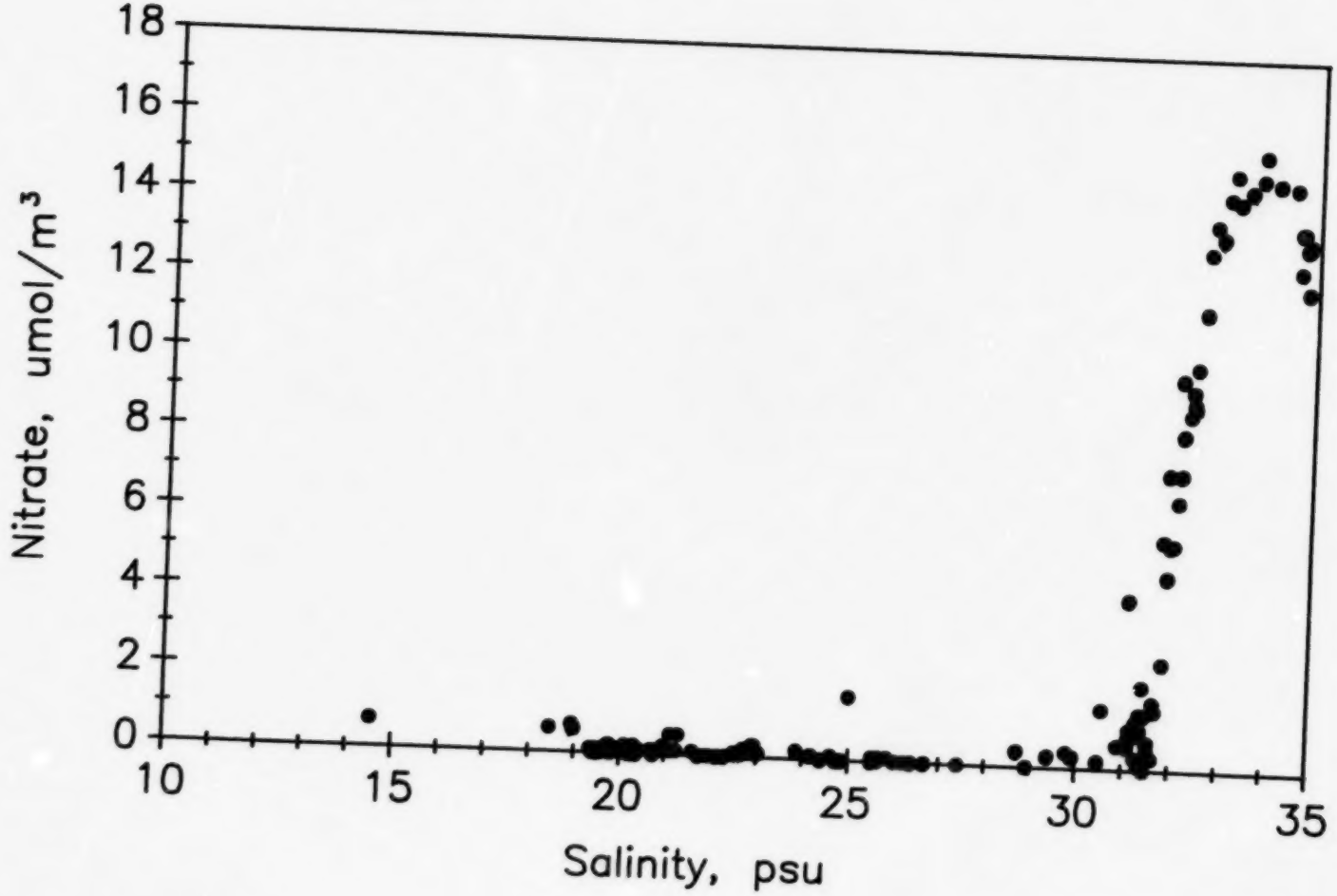
TIME: 2341 (Z+6)
LONGITUDE: 138 24.4 W

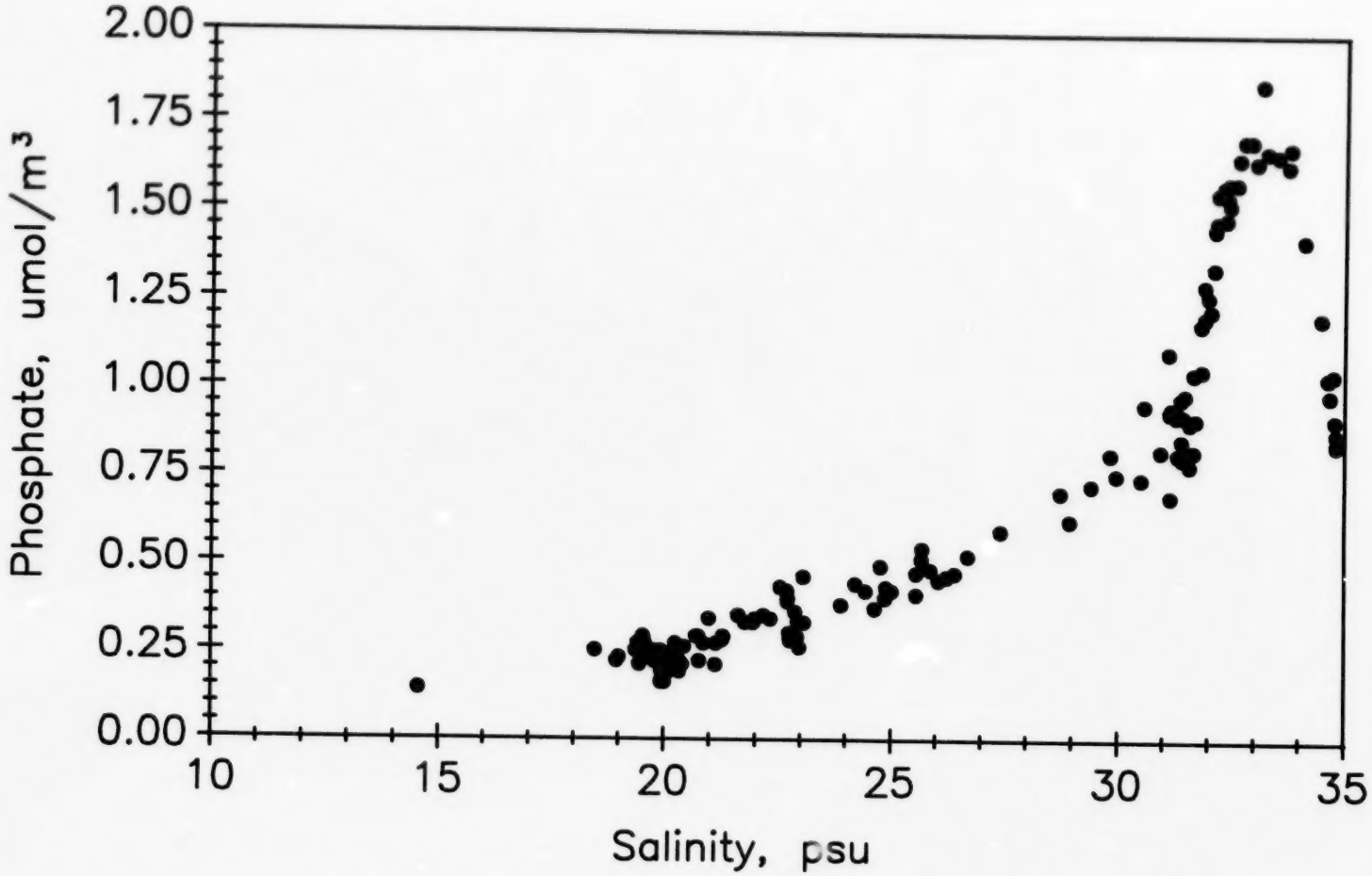
DEPTH m	SAMPLE #	TEMP. deg C	SALINITY X10^3	SIGMA-T kg/m3	OXYGEN mmol/m3	DELTA O18	PHOSPHATE mmol/m3	SILICATE mmol/m3	NITRATE mmol/m3
0	153	3.27	24.75	19.70		-6.6	0.49	10.4	
10	154	3.06	25.67	20.44		-5.6	0.54	9.5	0.1
20	155	-0.55	31.09	24.97		-3.5	1.10	14.9	4.3
30	156	-1.01	31.88	25.63		-3.7	1.29	21.9	7.5
40	157	-1.32	32.11	25.82		-3.3	1.45	24.5	9.9
50	158	-1.33	32.15	25.85		-2.9	1.47	24.6	7.5
65	159	-1.37	32.17	25.87		-2.6	1.55	25.5	8.5

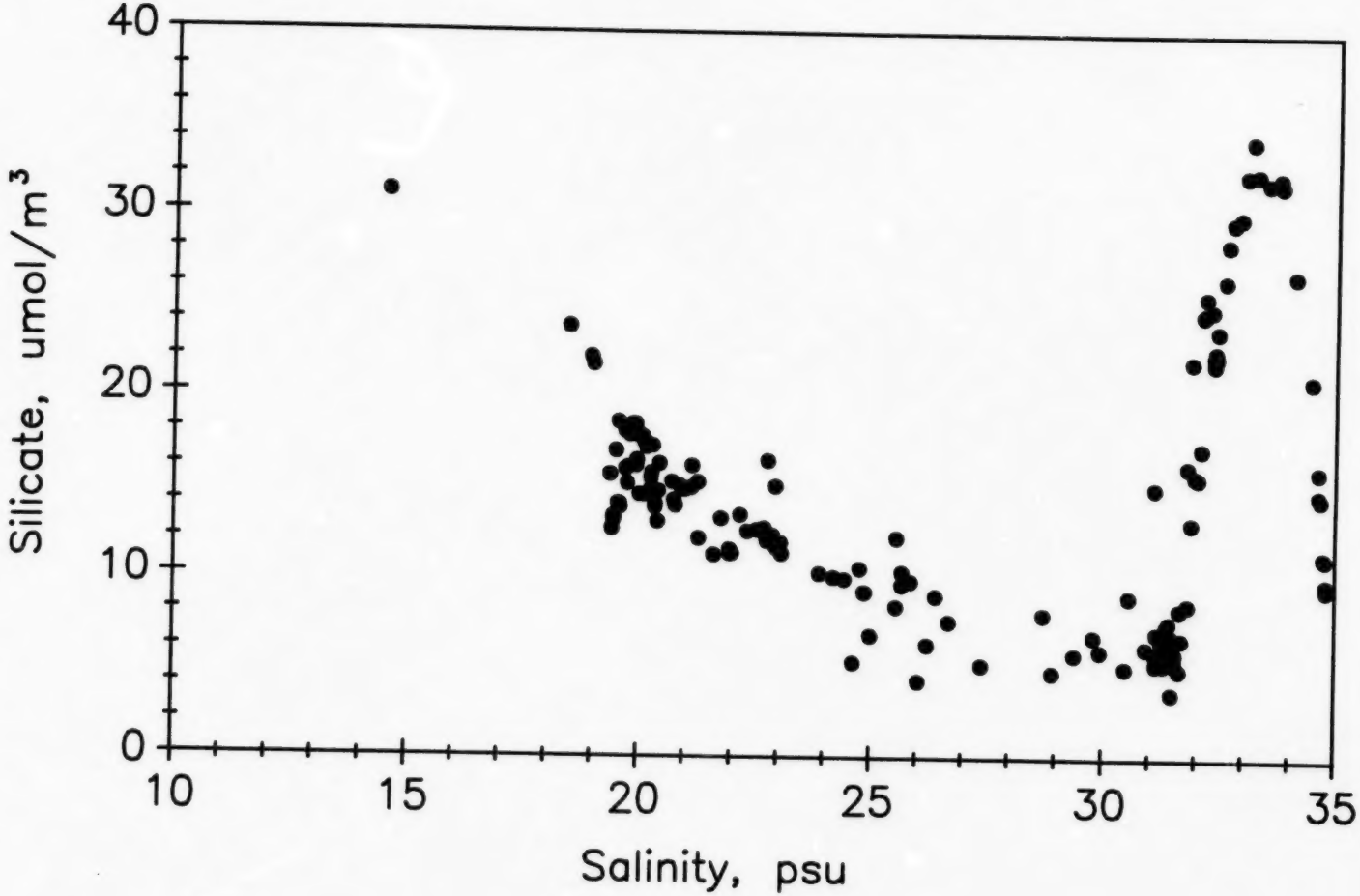
DEPTH m	SAMPLE #	POC CAST 1 ug/L	POC CAST 2 ug/L	PON CAST 1 ug/L	PON CAST 2 ug/L	CHLa CAST 1 mg/m3	CHLa CAST 2 mg/m3	PHEO mg/m3	TSS mg/L	BACTERIA 10^6/ml
0	153	129.4		18.7		0.443		0.190	3.26	
10	154	146.0		19.9		0.774		0.170	4.48	
20	155	154.6		19.8		0.552		0.253		
30	156	79.4		13.1		0.182		0.105	2.03	
40	157	67.2		10.4		0.142		0.117	1.90	
50	158	77.3		11.3		0.136		0.125	1.69	
65	159	156.9		19.9		0.162		0.159	3.92	

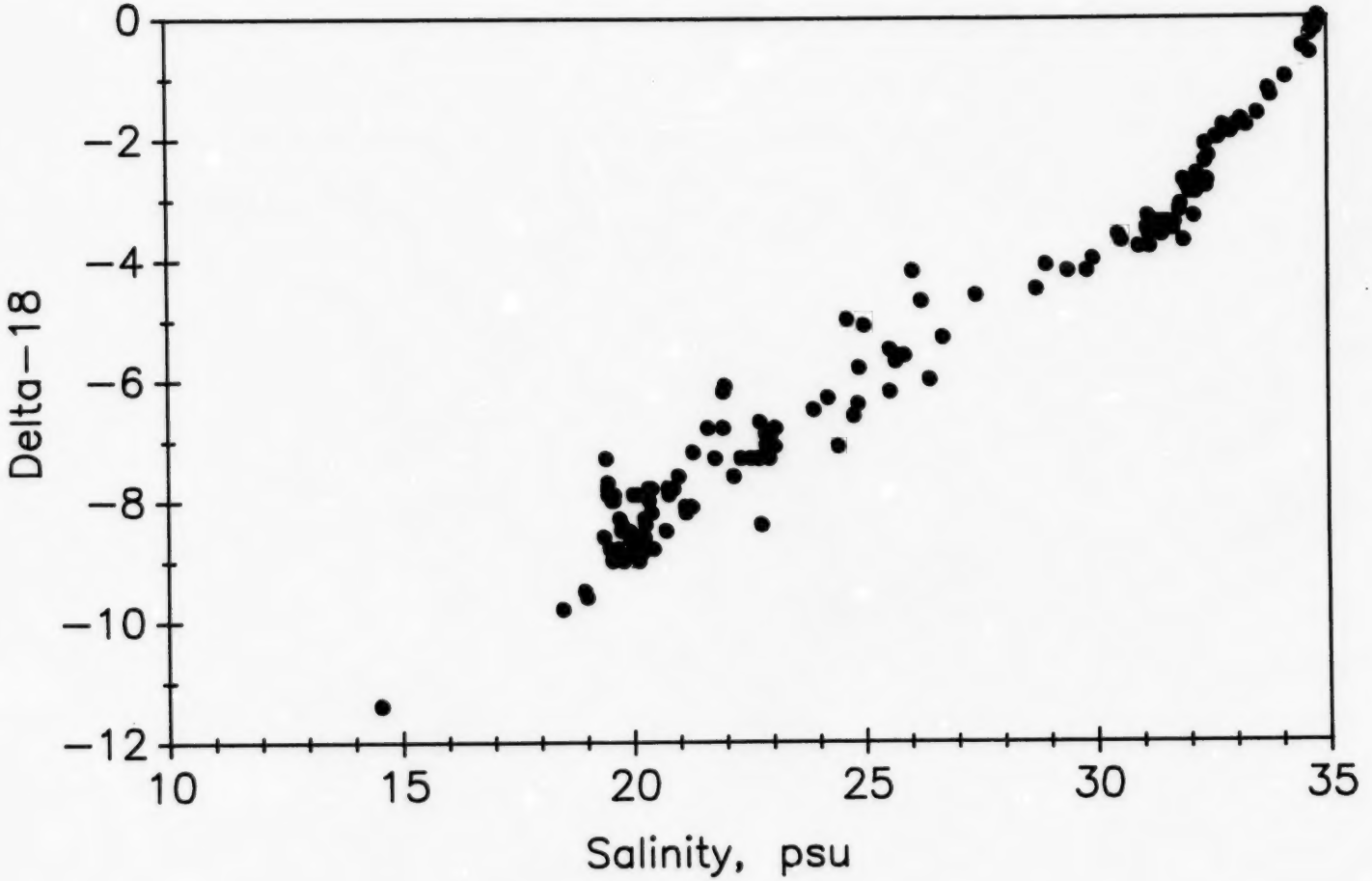
5 APPENDIX 2; SCATTER PLOTS

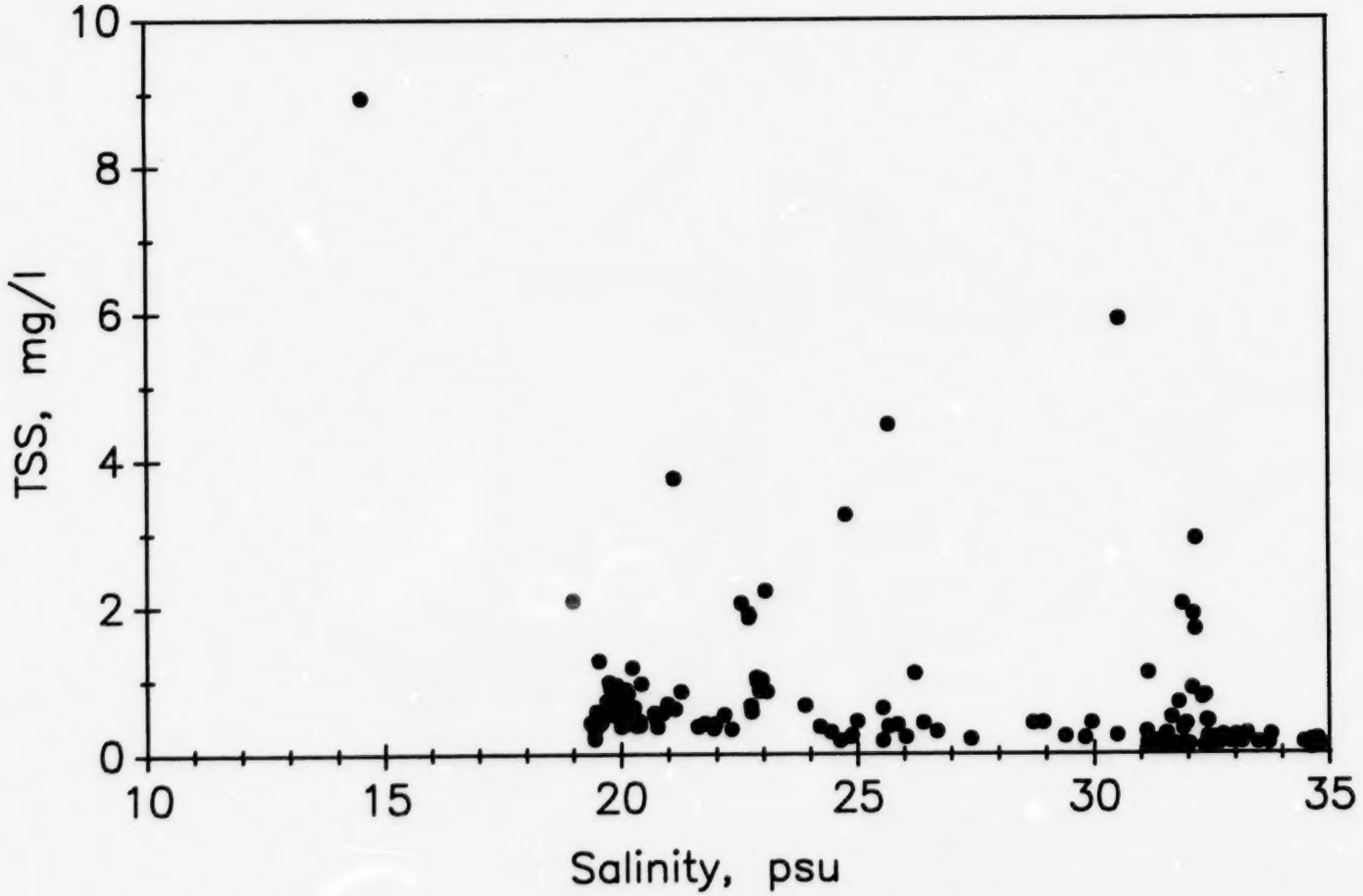

10
8
6
4
2
0
−2
Temperature, °C
10
15
20
25
30
35
Salinity, psu

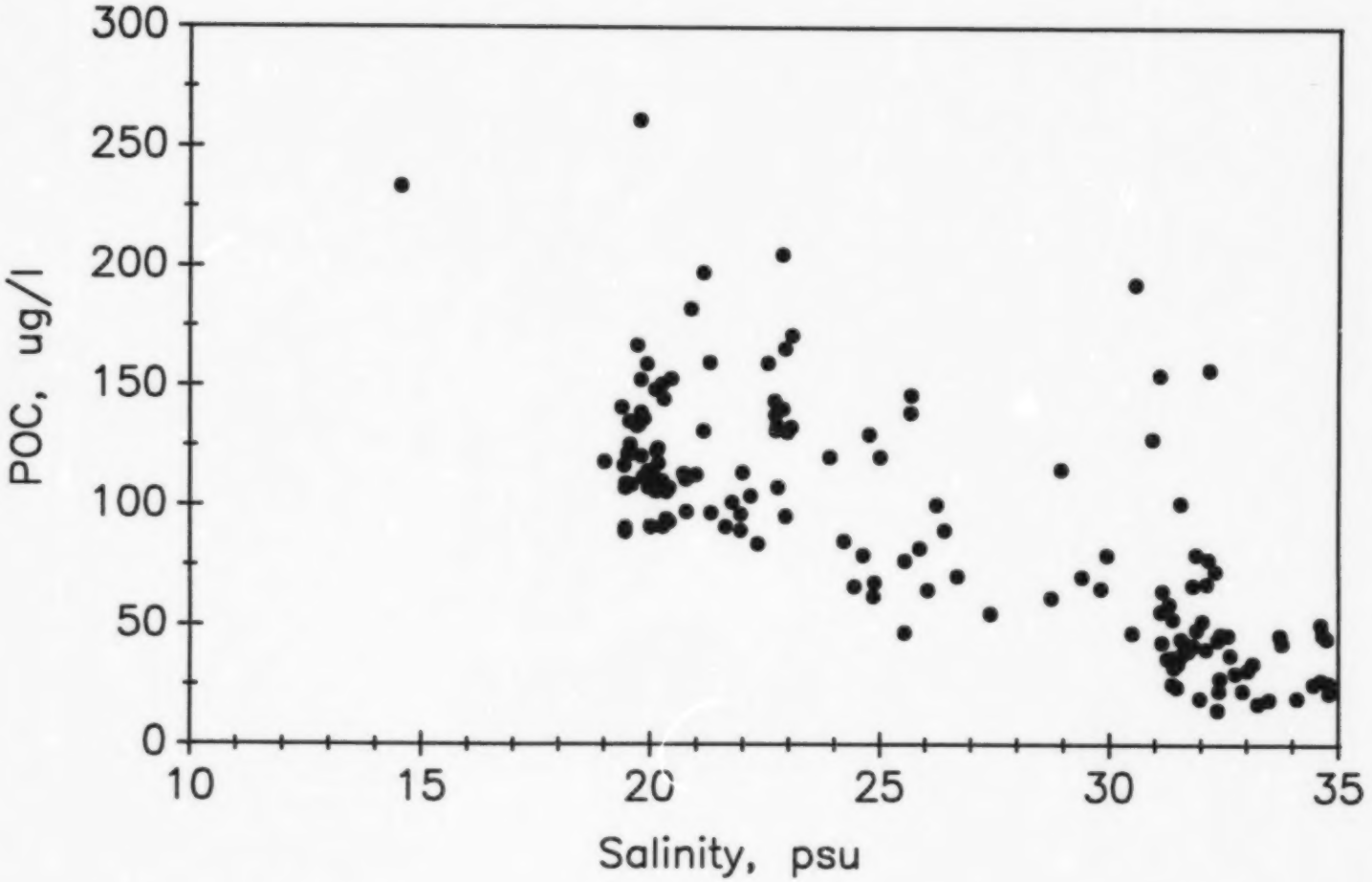

Nitrate, umol/m³
18
16
14
12
10
8
6
4
2
0
10
15
20
25
30
35
Salinity, psu

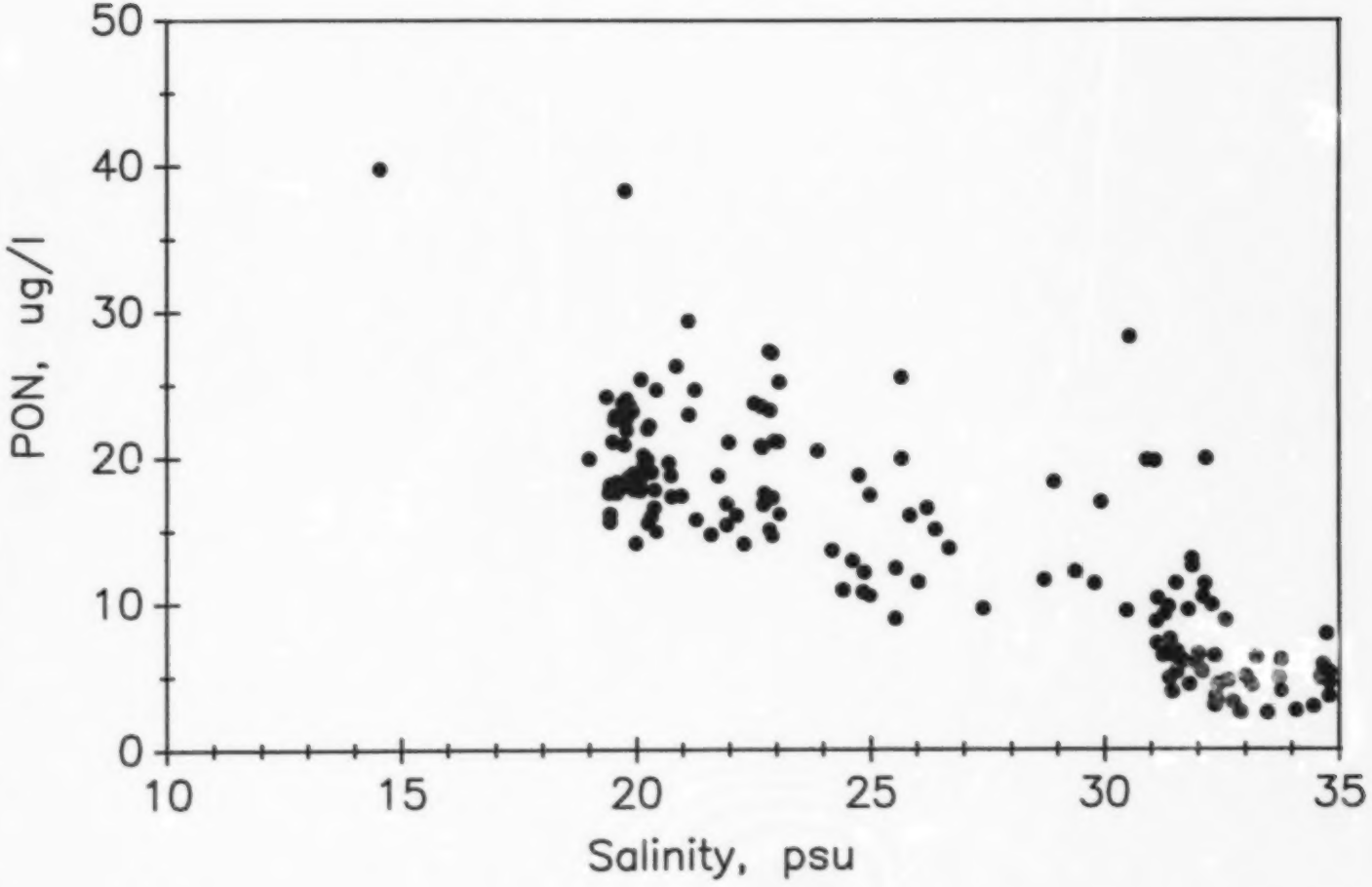

2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Phosphate, umol/m³
10
15
20
25
30
35
Salinity, psu

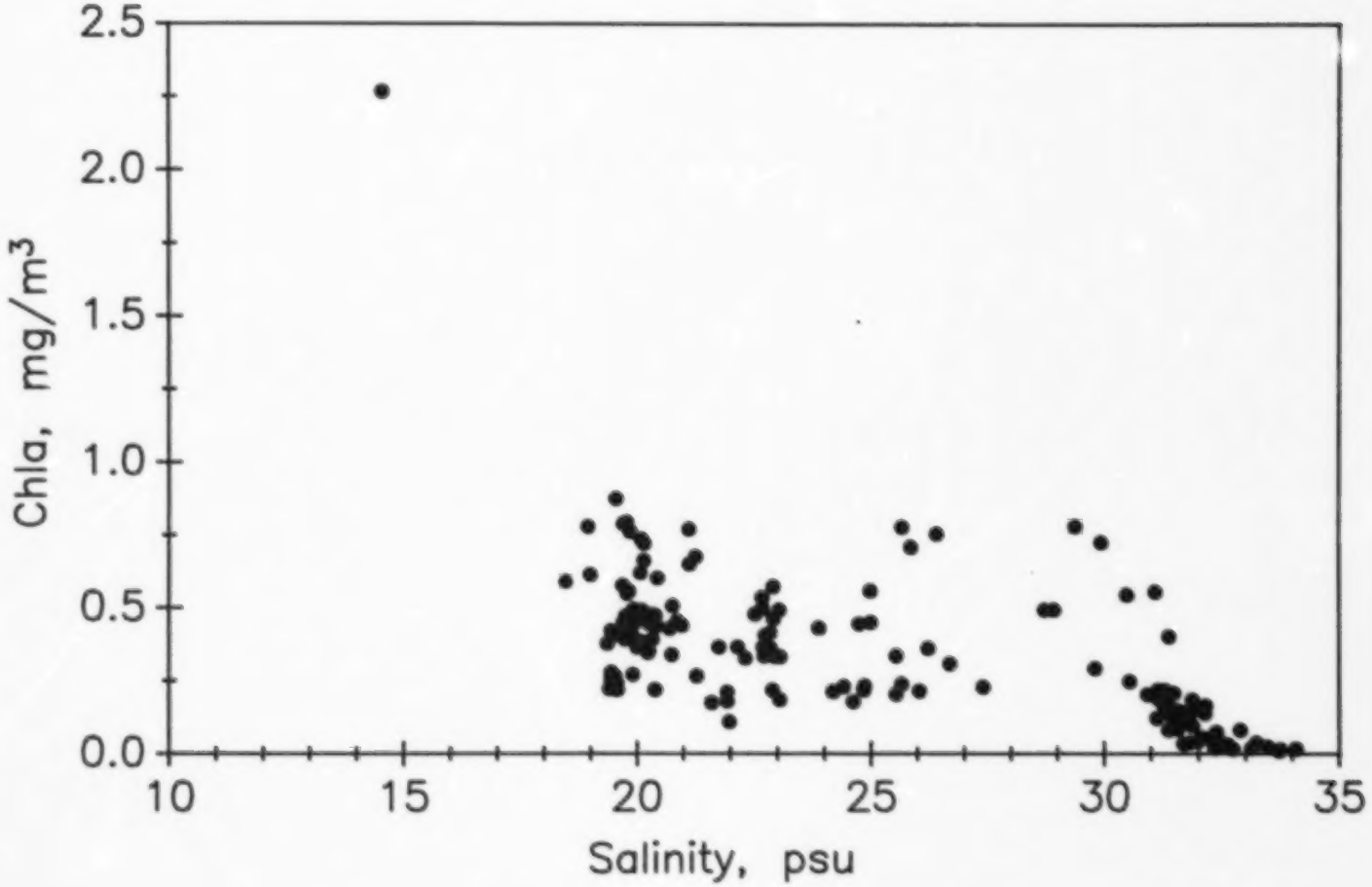

40
30
20
10
0
Silicate, umol/m³
10
15
20
25
30
35
Salinity, psu

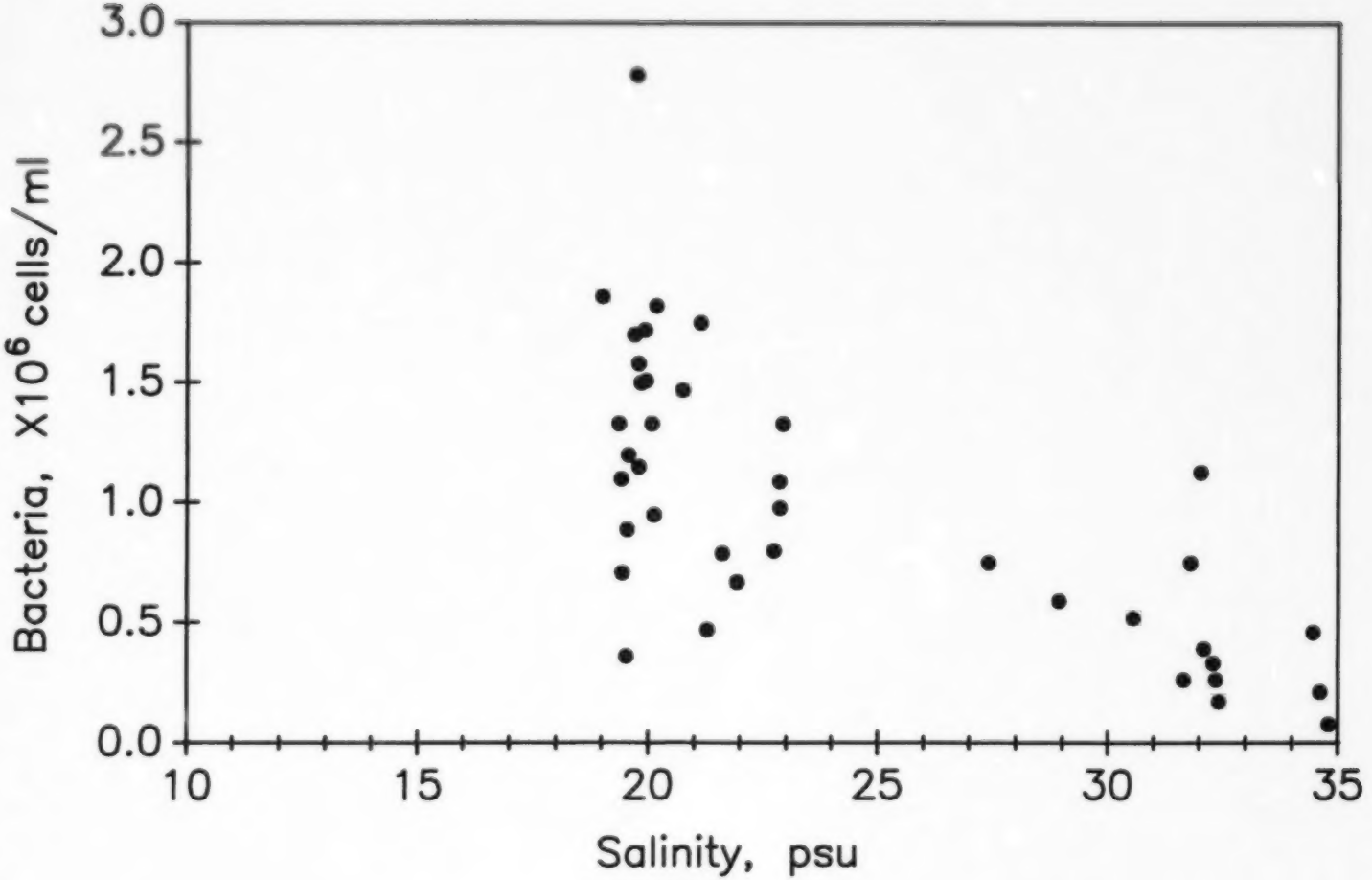

0
−2
−4
−6
−8
−10
−12
Delta−18
10
15
20
25
30
35
Salinity, psu

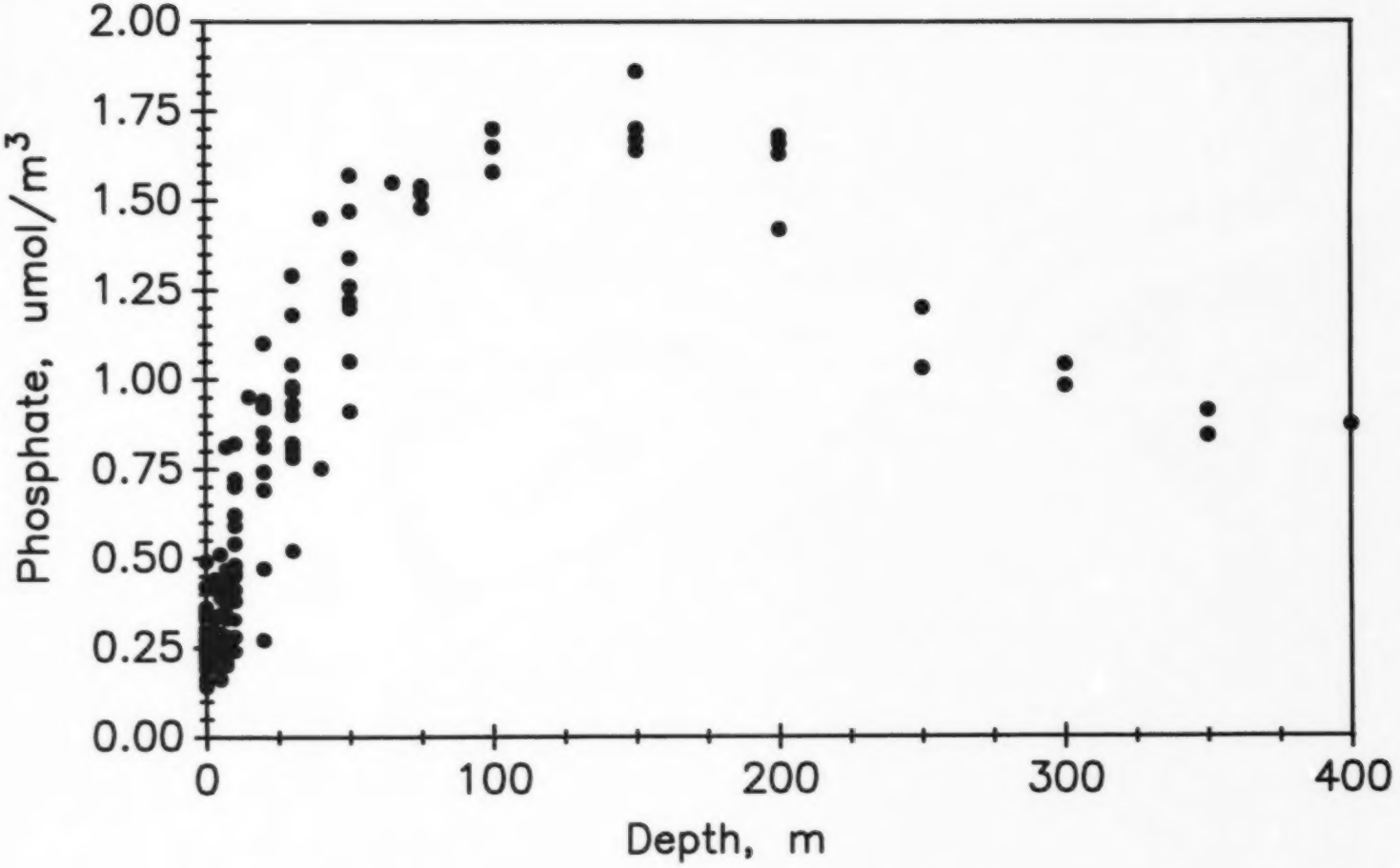

10
8
6
4
2
0
TSS, mg/l
10
15
20
25
30
35
Salinity, psu

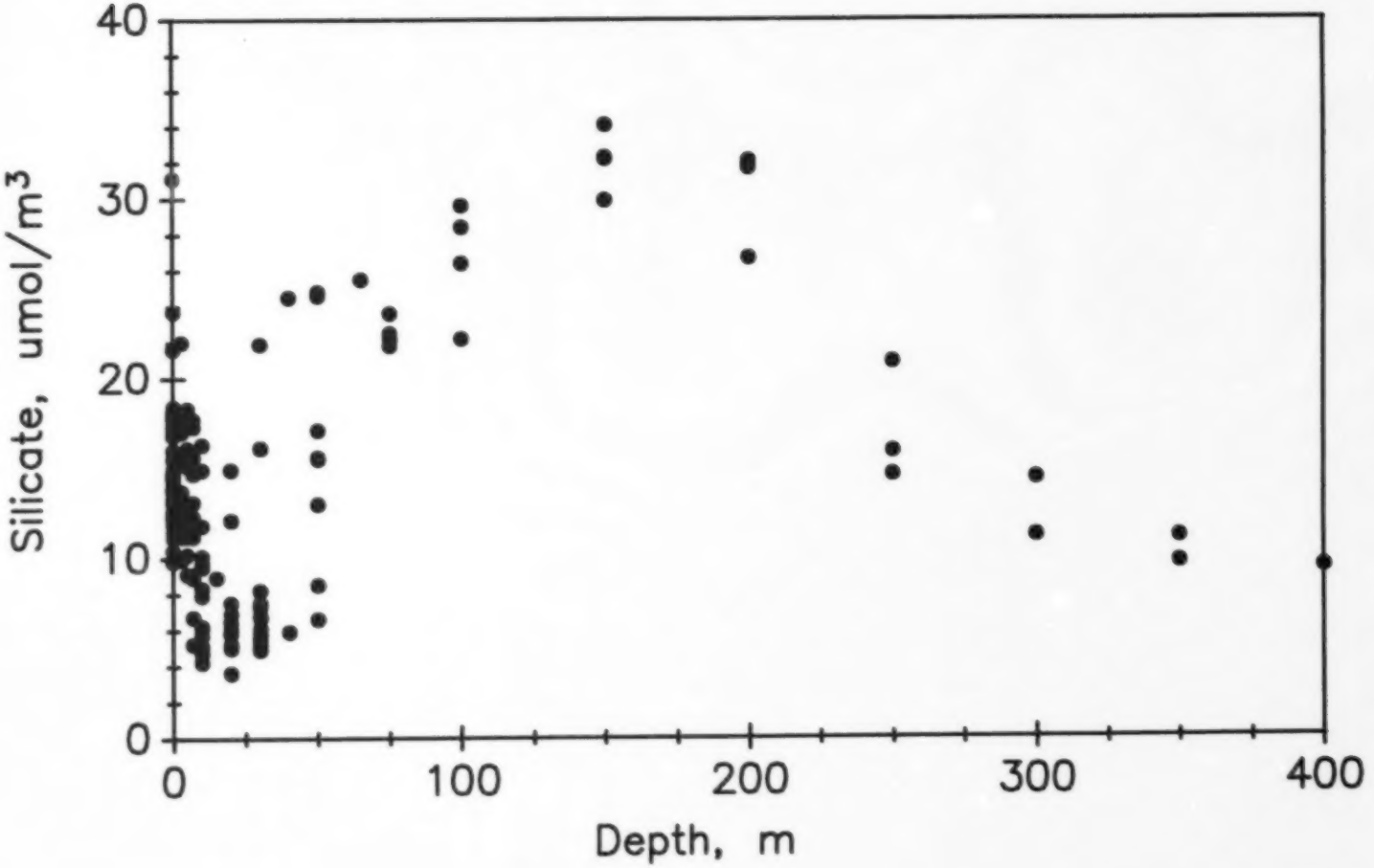

300
250
200
150
100
50
0
POC, ug/l
10
15
20
25
30
35
Salinity, psu

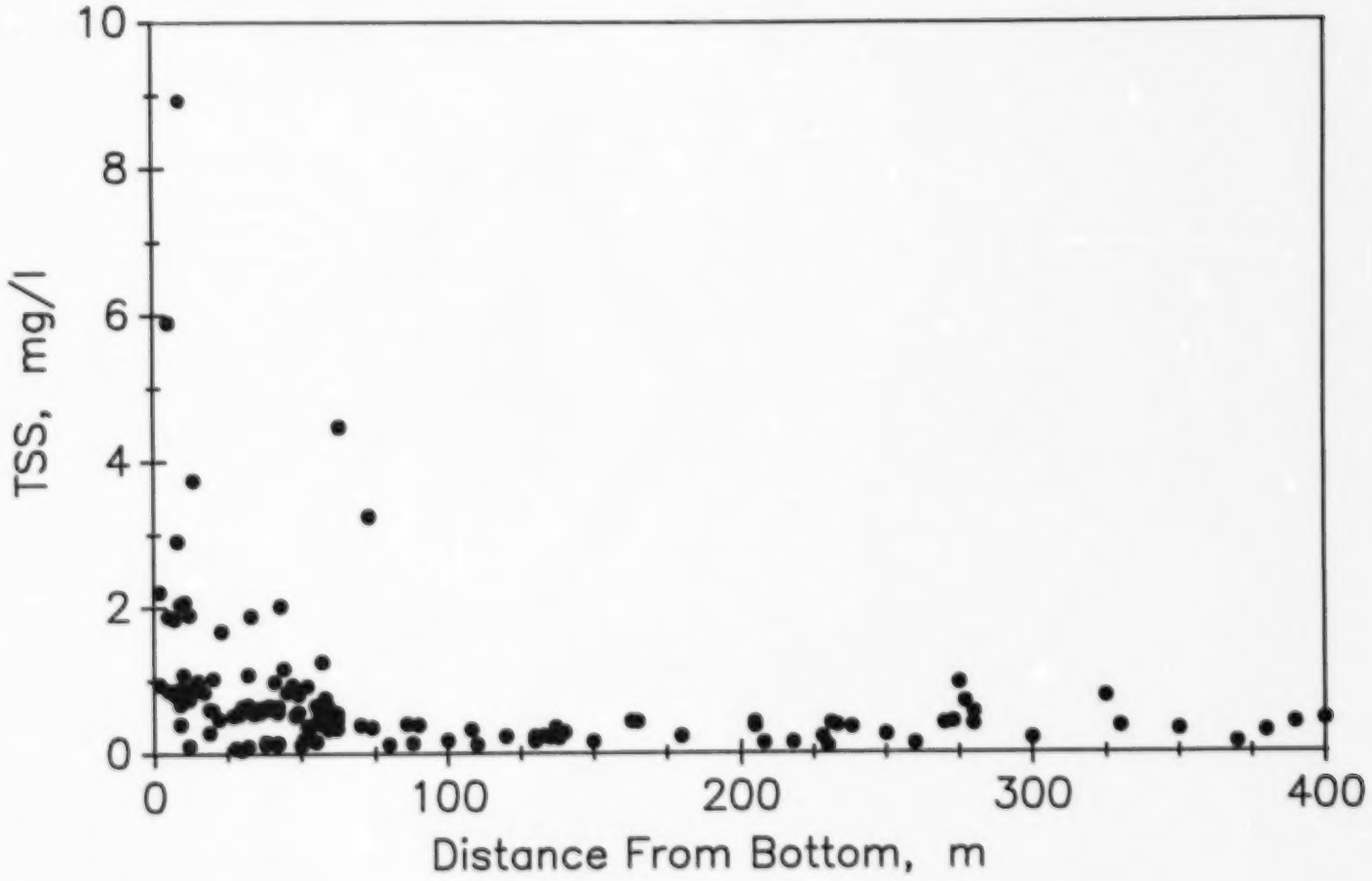

50
40
30
20
10
0
PON, ug/l
10
15
20
25
30
35
Salinity, psu

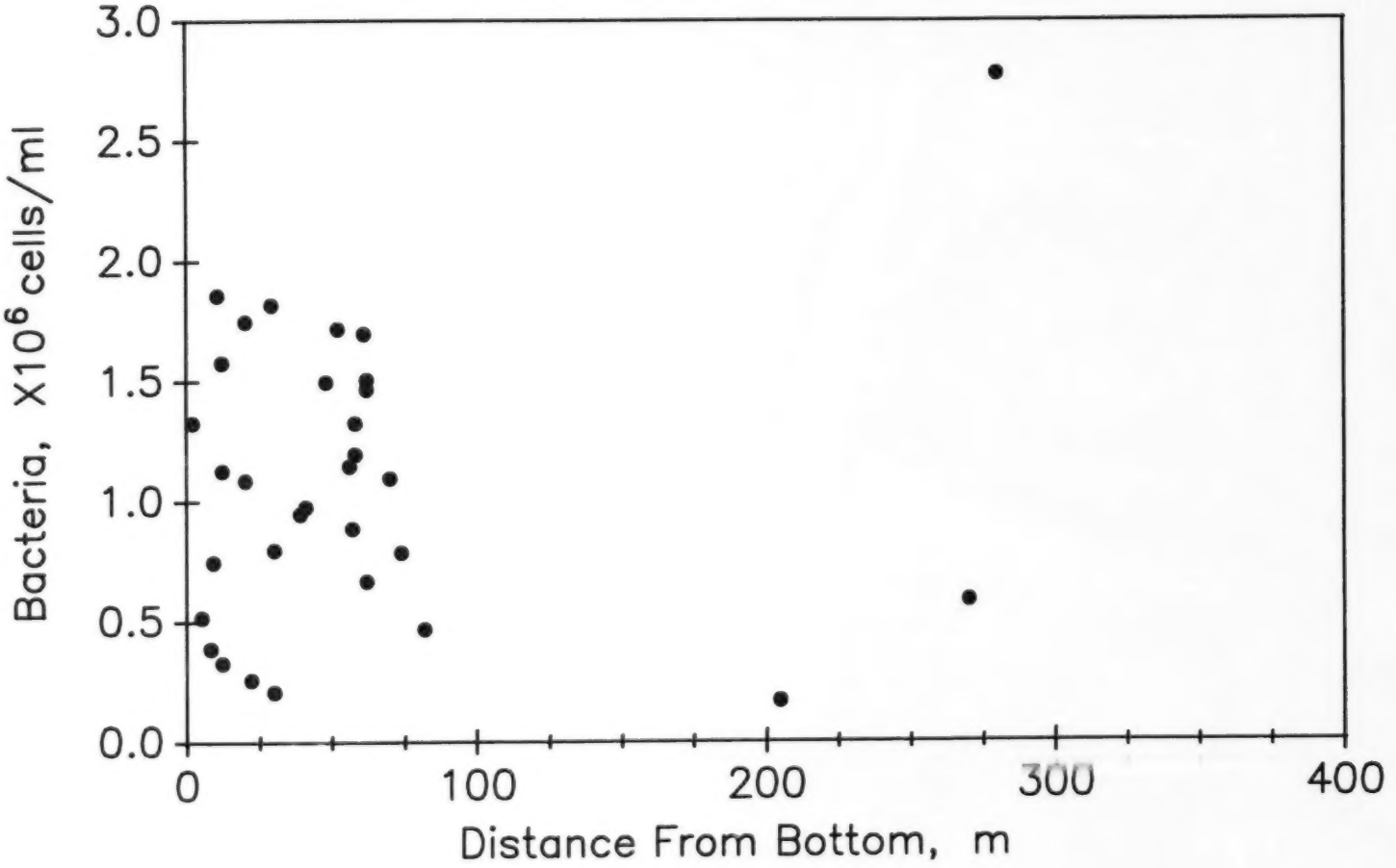

2.5
2.0
1.5
1.0
0.5
0.0
Chla, mg/m3
10
15
20
25
30
35
Salinity, psu

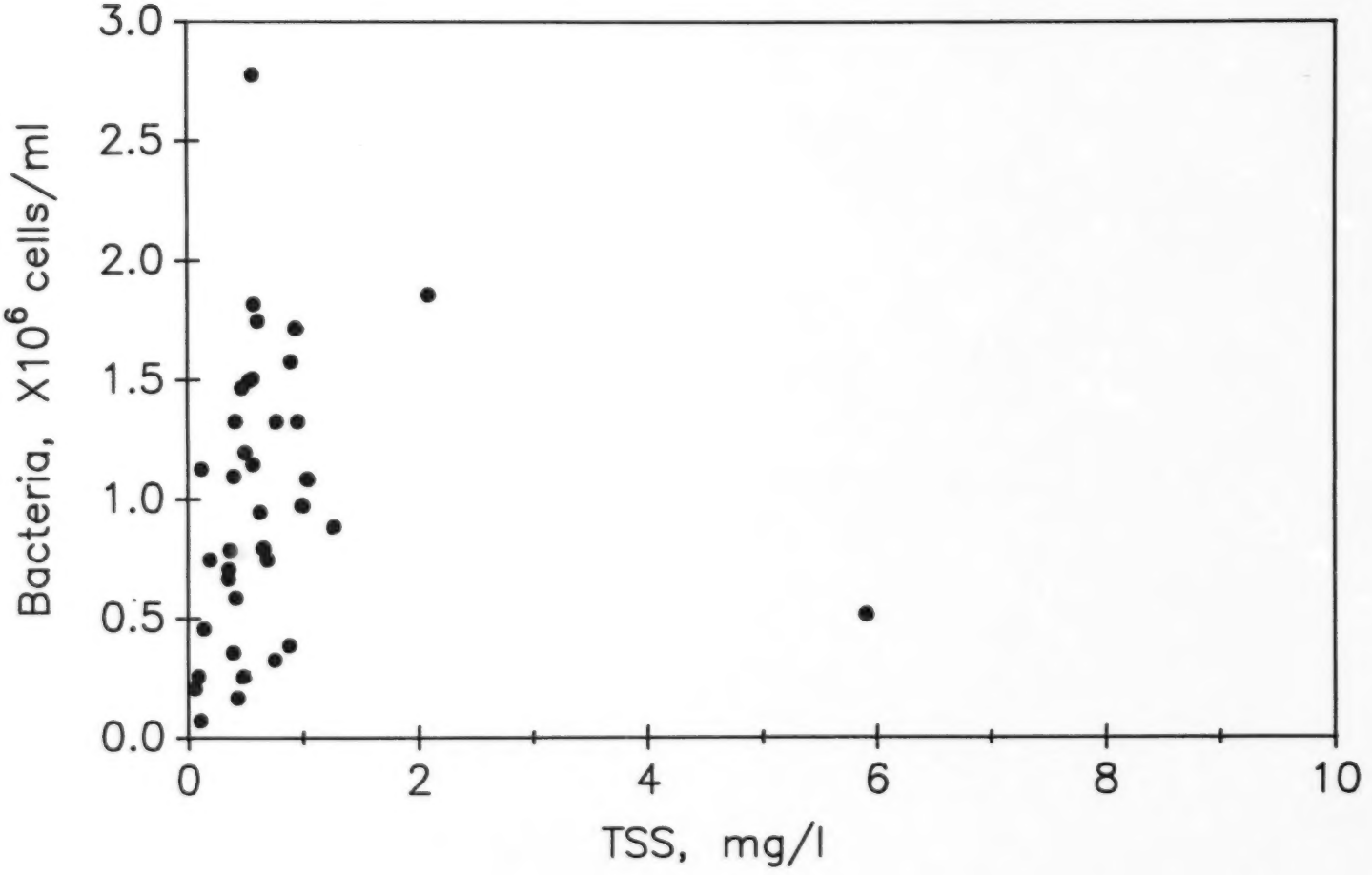

3.0
2.5
2.0
1.5
1.0
0.5
0.0
Bacteria, X10^6 cells/ml
10
15
20
25
30
35
Salinity, psu


2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Phosphate, umol/m3
0
100
200
300
400
Depth, m


40
30
20
10
0
Silicate, umol/m3
0
100
200
300
400
Depth, m


10
8
6
4
2
0
TSS, mg/l
0
100
200
300
400
Distance From Bottom, m


3.0
2.5
2.0
1.5
1.0
0.5
0.0
Bacteria, X10^6 cells/ml
0
100
200
300
400
Distance From Bottom, m


3.0
2.5
2.0
1.5
1.0
0.5
0.0
Bacteria, X10^6 cells/ml
0
2
4
6
8
10
TSS, mg/l